July, 1934

Fast Trains

Require SAFE Tracks

Safety under the new speed requirements demands adequate track fastenings.

RAIL ANTI-CREEPERS

thus become more important than ever before in making

THE FAIR

THE YANKEE CLIPPER ONE OF AMERICA'S FAMOUS TRAINS

THE YANKEE CLIPPER, 'flagship' of the New Haven Railroad's Shore Line Fleet, operates daily except Sunday on a fast 4¾ hour schedule between Boston and New York. Paralleling the course followed by old-time Clipper ships, each car of this fine day train is named for a famous nautical predecessor, and the connection is symbolized by a careful copy of an authentic painting displayed at the end of the car. Lavish appointments in its specially arranged Pullman parlor cars distinguish this famous limited train. Comfort for passengers is further insured by exceedingly careful attention to track maintenance, as is indicated by the use of *Spring Washers* meeting the latest A. R. E. A. specifications.

EATON MANUFACTURING COMPANY

RELIANCE SPRING WASHER DIVISION

MASSILLON, OHIO

Sales Offices: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco, Montreal

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Foreign.
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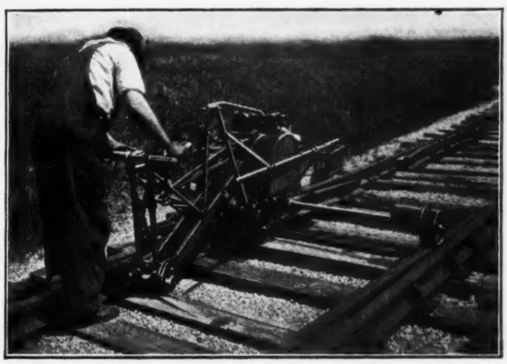
For Those Rail Reconditioning and Relaying Jobs

This Rail Grinder, which Nordberg recently announced, positively does a faster and better job than any other grinder on the market today. Smoother finished surfaces, longer grinding wheel life and a simplified operating mechanism are other features of this grinder.



A Nordberg Track Wrench should be at the head and rear of your relaying gang. Also can be used the year round for the maintenance of joints.

If you have a rail program this year, laying new rail or reconditioning rail in service, these machines are indispensable if you are giving serious consideration to quality of work done and what you can accomplish with a given appropriation. You will make no mistake if you join with other progressive maintenance officials, who have standardized on Nordberg Power Tools for track work.

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Pulling 35 to 40 spikes a minute makes the Nordberg Spike Puller a necessity for rapid progress wherever rail is removed.

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NORDBERG MAINTENANCE MACHINERY

WHEN MEN GO BACK TO WORK

IN the last six months more than 45,000 men have been re-employed in maintenance of way work.

In the month of May alone over 27,000 men were put back to work.

In this month more men were at work than in any month since June, 1932.

These men are creating markets for tools and for materials.

Are you as a manufacturer presenting your story to those maintenance officers who are preparing the programs and selecting the materials for this force of more than 225,000 men?

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

No. 67 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Our Oldest Advertiser

June 28, 1934

Dear Reader:

Who is your oldest continuous advertiser? This was the question put to me a few days ago. It started an interesting investigation.

As magazines go, Railway Engineering and Maintenance is not an old publication. It cannot point to a record like that of its associated publication, the Railway Mechanical Engineer, which celebrated 100 years of continuous publication two years ago. Neither can it lay to a continuity of service approximating that of its parent publication, the Railway Age, which was founded in 1856. Rather, Railway Engineering and Maintenance first appeared as an independent publication in May, 1916. Our investigation ran back, therefore, to that issue, since which time a total of 216 issues have been published.

Looking back through these issues, we find that one of our present advertisers appeared in the first or May, 1916, issue, and has not missed a single issue since that date. That company is the Ramapo Ajax Corporation, then the Ramapo Iron Works. Second only to this company in this respect is the Lundie Engineering Corporation which also started in the first issue and has missed only three issues in the 17 years that have intervened.

Next in seniority is the Woodings Verona Company which has not missed an issue since March, 1921. Other companies that have not missed an issue for lesser periods include the Timken Roller Bearing Company (7½ years), the Dearborn Chemical Company (6 years), the Nordberg Manufacturing Company (5 years), etc. There are still other companies whose advertisements have appeared in our papers regularly for years on schedules which provide for occasional omission of issues, notably the P & M Company which has been with us regularly since 1917, and the Armco Culvert Manufacturers Association which began in 1921.

We sincerely appreciate the manner in which these and newer advertisers have continued with us, especially during the last few trying years. The maintenance of our standards of service has been possible only through this co-operation. I know that you who read so regularly the advertising as well as the editorial pages of Railway Engineering and Maintenance have come to regard these companies as old friends whose messages you look for from issue to issue.

It is said that a publication is known by its advertisers. We are proud to be measured on this basis.

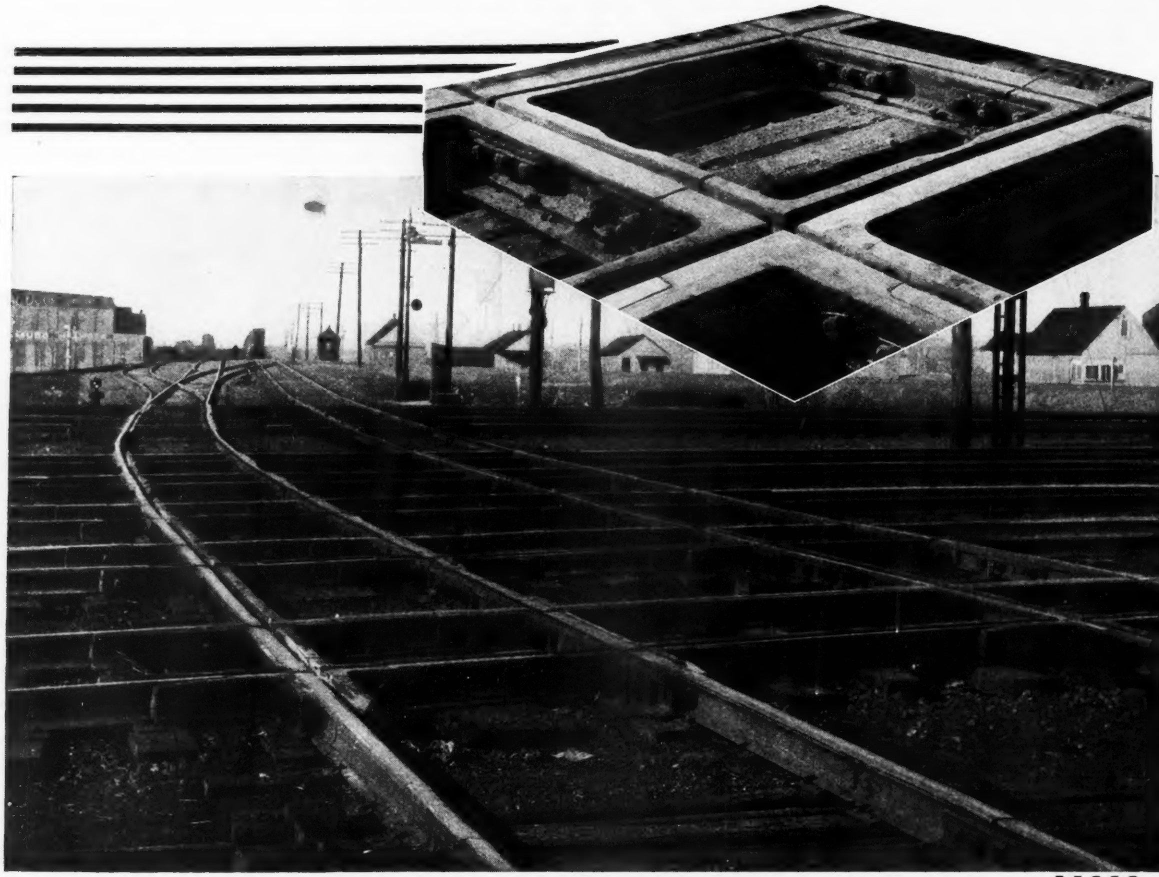
Yours sincerely,

Elmer T. Howson

ETH*JC

Editor

MEMBER: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.



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SAN FRANCISCO
58 Main Street

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Member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JULY, 1934

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Business Manager

Railway Engineering and Maintenance

WHEN DISASTER COMES

What Transportation Agency Affords Aid?

WHEN Henry L. Hopkins, director of the Federal Emergency Relief Administration, called on the railways a few days ago to reduce their rates on livestock and feed in the drouth stricken areas of the middle west, he gave recognition, unwittingly or otherwise, to the dependence of the public on the railroads in times of crisis. When the governors of several of the states followed with similar requests for aid within the limits of their respective commonwealths, they gave added recognition to the same fact. And when the roads gave almost immediate consent to these requests, they placed these areas under an implied obligation to them that should not be lightly disregarded when the emergency has passed.

This action to meet the needs of the people in these stricken areas was taken by the roads without hesitation, even though the lines were themselves facing heavy losses in traffic by reason of the crop failures. Furthermore, most of the roads were already sorely pressed and more than 40,000 miles of lines are already in the hands of receivers or undergoing reorganization.

The Present Crisis

This action of the railways stands out in striking contrast with the action of those other agencies of transportation which have been making such inroads on the traffic of the railways of late. Nowhere have we seen either an appeal to or an offer from the motor truck operators to reduce their rates, as the railways have done, even though in many of the drouth-afflicted agricultural areas they have previously taken as much as 60 to 80 per cent of the livestock traffic from the railroads. Nor have we seen any similar interest in relief displayed by the carriers on the waterways or in the air. Rather, in times of disaster, they are content to let the railways carry the burden alone.

If this action of the railways in coming to the aid of a sorely pressed people this year stood by itself, it would still be worthy of high commendation. But it is not an isolated instance. Rather, it is indicative of a long maintained interest in the problems confronting the areas served by their lines and a willingness to share in their solution.

As early as last November the railways made reductions in their freight rates on all food products shipped for relief purposes. Again on March 2 of this year they lowered their rates on bituminous and anthracite coal shipped by the federal or state governments for relief purposes. Likewise, passenger fares have been cut 50 per cent for transient relief workers.

No figures are available to measure the magnitude of the contribution which the railways have made, through these various measures, to the relief of the needy, but reports made to the federal relief administration indicate that up to May 1 more than 40,000 carloads of freight were transported under reduced rates. These shipments do not, of course, include any of the shipments of livestock and of feed under the new rates or any of the regular relief shipments made during the last 60 days. Taken in the aggregate, the contributions which the railways have made to the relief of the needy through reductions in their legitimate charges for transportation total many millions of dollars—and they are still continuing to make inroads on their revenues.

A Consistent Record

Nor has this action in turning to the railways for aid been confined to the present crisis. In the summer of 1930 when large areas were facing widespread disaster from drouth, President Hoover called on the roads for a 50 per cent reduction in freight rates to meet that emergency and the promptness of their response was such as to cause the President to express publicly his "high appreciation of the railways for their prompt and constructive action," which he termed "a notable act of courageous co-operation undertaken in the face of seriously reduced income due to the depression."

Equally prompt has been the response of the railways to needs arising from other national emergencies. The last great flood in the lower Mississippi valley in the spring of 1927, affords an example. Here also, after suffering losses on their own account of $10,000,000 in physical damage and protective measures prior to and during the flood, they took the leadership in directing the relief work. In hundreds of localities they stood by the various communities to the last and then transported the people, their livestock and their property to points of safety. In this activity they operated more than 400 relief trains, and handled nearly 5000 carloads of provisions, boats and other supplies, practically all free of charge. They likewise provided more than 5000 box cars for living quarters for refugees, many for periods up to 60 days. A single railroad, the Illinois Central, spent more than $387,000 in direct relief alone.

Such has been the record of the railways in meeting disaster, wherever and in whatever form it has occurred. During the forest fires of Wisconsin-Minnesota a few years ago, the railways placed all their facilities at the disposal of the fire fighting forces, and as communities were overwhelmed, they brought out the refugees. Likewise, when the Colorado river threatened to leave its course in and make a lake of the Imperial Valley in Southern California some years ago, it was the Southern Pacific with its equipment, its forces and its funds that saved the situation after the federal government had confessed its inability to cope with the problem. And many other illustrations might be cited.

Good Business to Foster Railways

It is perhaps only natural that the public should turn to the railways for aid and for leadership in times of disaster—it is a tribute to and a recognition of their efficiency. It is equally an admission of dependency on the railways. Yet, when no disaster impends, the public is turning today all too largely to other forms of transportation without thought of the fact that by so doing it is threatening the continued existence of the one agency that has, on so many occasions, demonstrated its willingness and its ability to come to the aid of any community when that aid is sorely needed.

It is here that the railway employee has a responsibility—to see that those in his community who are patronizing other transportation services realize the full ultimate effects of such action. They can point out that these competing agencies have accepted none of the responsibilities of a neighbor, leaving to the railways the burden of providing transportation for stricken communities and individuals, but at the same time continuing to make still greater inroads on that portion of the railway traffic that can be handled with profit. As between individuals, such action brings condemnation to the offender. It is no less reprehensible among corporations.

Surely if the railways are the one essential agency of transportation in times of drouth, flood or fire, it is good business, as well as justice, to see that they are allowed to prosper in more normal periods. It is only by such a course that it can be assured that they will be available and prepared to serve when a disaster occurs.

THE WEATHER

Has Favored the Track During the Depression

IT IS a singular fact that the years of the depression have been characterized by weather conditions that have been exceptionally favorable to the upkeep of tracks with a minimum of expenditure. Obviously, no generalization can be applied to so large an area as the American continent without running counter to the facts as regards limited areas or periods of time. But, taken as a whole, conditions have been better than those representing the average of experience over a long period.

Of the five calendar years since the stock market panic of 1929, only one, namely, 1932, was a year of more than average rainfall, and the excess in most parts of the country that year was moderate. Of the other years, 1930 and 1931 embraced a period of almost unprecedented drought, while 1933 was a period of subnormal precipitation over a large area, followed by a winter of low rain or snowfall throughout the middle west and culminating this spring in a drouth of major proportions.

This does not mean that the railroads have not suffered from floods and washouts to a degree approaching average experience, nor does it imply a lowering of ground water to levels that would result in a general freedom from soft roadbed troubles. However, a widespread deficiency in rainfall in four years out of five, is certain to result in a greater average solidity of roadbed, taking the country as a whole. Furthermore, exceptionally favorable conditions were experienced during the last winter in large areas of the middle west, where troubles from frost were reduced to the minimum by the low level of ground water. This situation stood out in sharp contrast with that prevailing eight years ago when the railroads were confronted with heaving track in locations that had not given trouble within the memory of most maintenance men.

These providential circumstances have served to ease the task of the track maintenance officer during a period when expenditures have limited activities to minor upkeep and unavoidable renewals. Only in exceptional cases has attention been given to those items of general overhauling that are essential elements in the program of keeping the track fit for service under the unfavorable conditions that may be imposed at any time, but which have been singularly absent during the last five years. It is for these reasons, in the face of the favorable record of track performance during the last four and one-half years of curtailed maintenance, that greater attention must be given to the ballast and the roadbed as well as to the rails and ties.

WEED CONTROL

Can Be Established by Persistent Effort

SEVERAL methods, which have demonstrated both efficiency and economy, have been developed and are widely used for destroying weeds in the ballast and on the shoulders of the roadbed. These methods are effective not only in the destruction of the present crop, but where applied persistently they assure a reduction in the amount of vegetation that will grow in succeeding seasons, thus setting up a definite control of the growth within these limits. Beyond the shoulder a limited amount of control has been exercised through the use of track mowers, which are used to cut one or two swaths outside the ballast toe line.

The elimination of weeds on the right of way, beyond the reach of track-mowing equipment, constitutes a problem as old as the railways themselves. That it is difficult of solution is indicated by the fact that, in some cases, the most extreme measures of eradication fail to give satisfactory results. So far, no formula has been developed for its solution and today, in contrast with the facilities available for killing weeds in the track, the

matter rests about where it did a half century ago. The need for eradication has increased, however, as the country has developed, as the population has increased and as traffic has spread many varieties of noxious weeds into sections to which they are not native.

Complete and permanent eradication of all vegetation from the ballast is desirable. This is also generally, but not always, true of the shoulder of the roadbed. Under some conditions it might be little less than a catastrophe out on the right of way. The ideal condition is to have the right of way well-sodded and free from noxious weeds. In most sections, a reduction in the number and variety of noxious weeds will encourage the spread of native or other satisfactory grasses and thus extend the sodded area.

Most varieties of weeds can be brought under at least partial control by not allowing them to go to seed, although this is not true of certain types, such as Johnson grass, Bermuda grass, bindweed and morning glory. Experience has shown that there is no better means of preventing seeding than to cut the plants before they reach maturity. When this is attempted, however, it is discovered that the problem is not as simple as it seems.

All varieties of weeds do not mature at the same time, so that cutting early to eradicate one kind may not affect the seeding of another. Again, if the cutting is done late, some kinds may have already seeded. If two cuttings are made, a few plants may be expected to reach maturity during the interval. For these reasons, the number of cuttings as well as the time when they should be made will depend in large measure on the variety of weeds encountered, the length of the growing season and other climatic conditions. In some sections a single cutting will suffice; in others more than two may be required. In any event, however, persistent mowing, based on all of the factors that must be considered, should eventually result in complete or partial elimination of many varieties of noxious weeds and an extension of the area occupied by grasses, thus improving appearances as well as reducing the cost of weed destruction.

BUILDINGS

Must Be Kept Safe at All Times

THE failure of the supports of a water tank on the roof of a building in Chicago several weeks ago, resulting in the death of several persons, serves as a reminder that the structural soundness of buildings must not be overlooked. Owing to the chaos of wreckage produced by this accident and lack of technical supervision in the subsequent salvage operations the cause will never be known, except that the city building inspector who examined the tank and its supports a short time before the failure, admitted his incompetence at the coroner's inquest.

The natural reaction of a railway maintenance officer is that such an accident could not occur on a railroad, because of the organization provided to insure competent design prior to construction and by reason of adequate inspection by trained men during the life of the structure. But is it safe to take such a complacent attitude? The railways have been compelled to reduce the supervisory staffs, as well as the working forces of their maintenance organizations, with a resulting increase in responsibilities and a necessary concentration of attention on those operations that have to do with the safety of transportation. This has commonly been interpreted as justifying a concentration of attention on the tracks and bridges, with a corresponding neglect of buildings.

The example cited related to the hazard imposed by the concentration of a rather heavy load on the roof of a building. But the things that can happen to buildings of the many types to be found on a railroad are too numerous for detailed review. The roof of a roundhouse may become so weak through decay as to possess inadequate strength to withstand a heavy snow load. Settlement of foundations or decay of posts may cause a freight platform or a shed to lean over far enough to encroach dangerously on the operating clearance of an adjacent track. The bracing of tall or elevated structures may offer insufficient resistance to the force of high winds. But why go on? Many other contingencies will suggest themselves, and perhaps more important than the examples cited, which point to major accidents, are the little things that increase the hazard of injury to employees or patrons of the road.

Investigations following building disasters have not infrequently disclosed conditions reflecting gross incompetence on the part of the designers, failure to adhere to the plans during construction, or subsequent alterations that weakened the structure. The detection of such conditions calls for examination by one who is thoroughly trained and experienced in design, but as such conditions are rarely encountered on the railways, it is not a matter of direct moment. However, it behooves the railway inspector to be on the alert to detect changes that may affect the safety of a structure, the most common among which is the overloading of floors. Still another is the supporting of jib cranes from building walls or columns or of other equipment from roof trusses, by forces of the using department without consultation with the building department.

On the whole, however, it is the elements, rather than man, that are responsible for the deterioration that leads to serious structural weakness. And in the detection of these conditions there is no substitute for sufficiently frequent inspections by men who are keen observers and who have the knowledge and experience necessary to interpret what they see. But the examination of buildings and other structures for the detection of defects should not be relegated entirely to the inspectors or confined to periodic inspections by division or superior officers. All officers, including the foremen, should be constantly on the alert to detect conditions that point to distress or deterioration of the structures that they see.

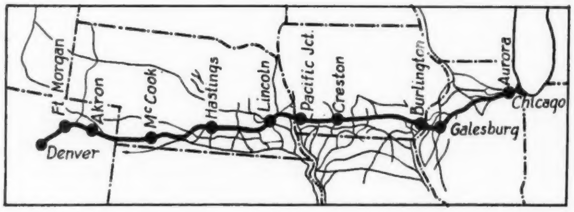
A Thousand Miles in Thirteen

Diesel powered, streamlined "Zephyr" of the Chicago, Burlington & Quincy established new records for long-distance, high-speed rail travel in a run from Denver to Chicago on May 26. Maintenance of way officers had an important part in the preparations for this epoch-making trip by effecting a careful adjustment of speeds to track conditions in order to insure safety.

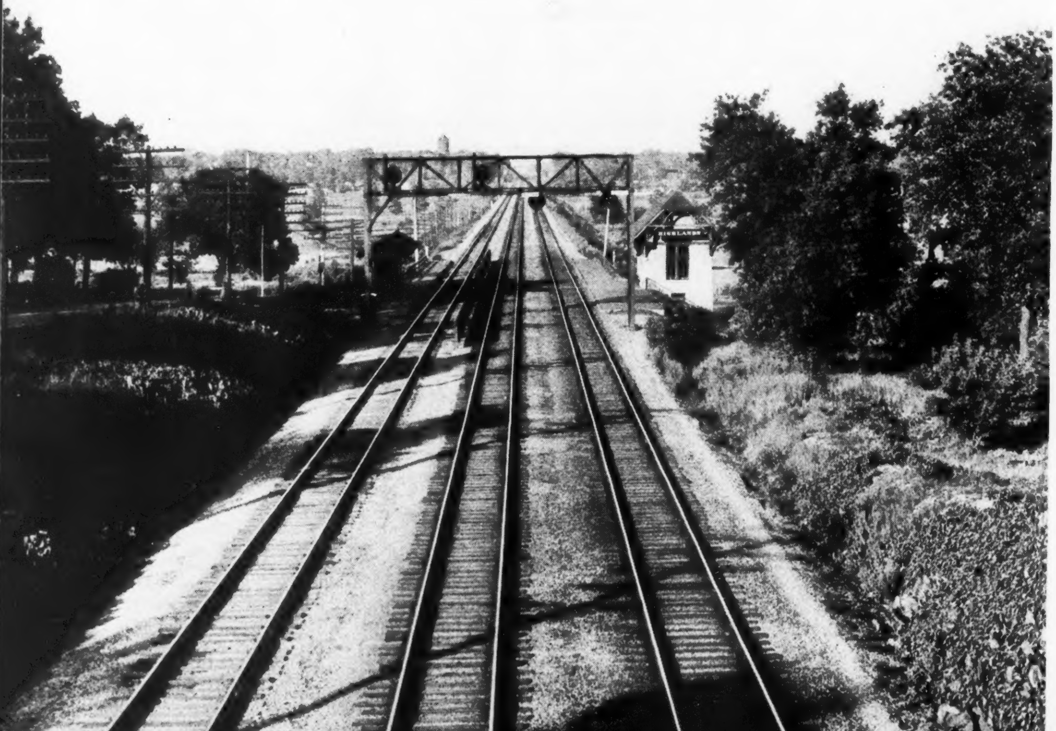
RIDING in the cab beside the motorman, engineers maintenance of way of the Chicago, Burlington & Quincy, served as co-pilots of the Zephyr, three-car Diesel-powered streamlined passenger train on May 26, when it broke all records for long-distance, high-speed rail transportation on a non-stop run from Denver to Chicago in 13 hr. and 5 min. It was in large part by reason of the advance information as to grades, alinement and maximum safe speeds relayed by maintenance officers to the man at the controller that this run of 1,015.4 miles was made at an average speed of 77.6 miles per hour, that the distance of 129.5 miles from Otis, Colo., to McCook, Neb., was covered at the average rate of 90.0 miles per hour and that the train traveled the 19.1 miles between Otis and Schramm at the rate of 106.2 miles per hour. The maximum speed attained on this run was 112.5 miles per hour.

Back of these records lies a study of track, and especially of curve conditions, that is as outstanding in its thoroughness and accuracy as are the speed records themselves. It is by reason of this knowledge, as well as because of the elaborate precautions taken to avoid all interference at highway and other grade crossings that the Zephyr, with its load of more than 100 passengers, was enabled to travel the distance of more than 1,000 miles in less than half the time of the fastest scheduled trains with comfort and safety comparable with that of these regular trains. It is with these preparations and precautions that this article will deal.

The Zephyr is a light-weight, streamlined train equipped with a Winton two-cycle, eight-in-line, high-compression, 600-hp. Diesel Engine which serves as the prime mover direct-connected to the electric generator that supplies current to the traction motors mounted on the front truck. The train consists of three cars with a total length of 197 ft., constructed as an articulated unit and supported on four four-wheel trucks, one under the power plant at the front end, another under the rear end of the rear trailer car, and the other two under the articulated connections between the cars. Through the use of thin sections of stainless steel and other high-strength steel alloys, the weight of the train has been limited to about 200,000 lb. Of the normal loaded weight of the train about 40 per cent is carried on the front truck, owing to the weight of the power plant.



The Route of the Zephyr from Denver to Chicago

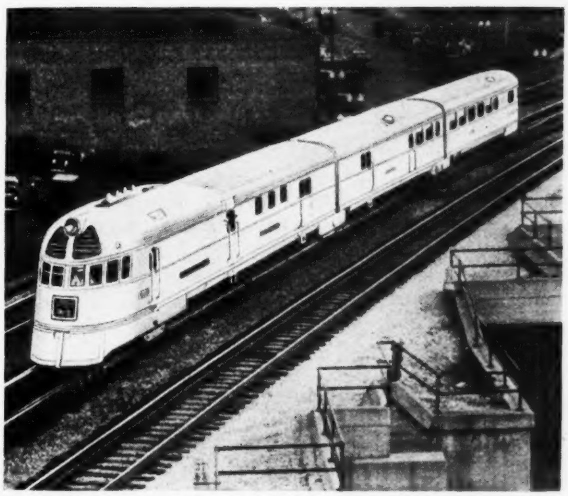


East of Aurora, Ill., the Zephyr Was Routed Over the Middle Track of the Three-Track Line—View Near Hinsdale

Hours

At the Right—Triumphant Entrance of the Zephyr on the Stage of the "Wings of a Century", the Classic Pageant of Transportation at A Century of Progress Exposition, Chicago

Below—Passing Through Aurora, Ill., at 6:41 P. M.



This record flight of the Zephyr was made over a line that embodies what may be termed typical main line standards and characteristics for the better class of railroads operating west of Chicago. The rail ranges from 90 lbs. to 112 lbs., the ties are plated and a high average condition is maintained. The ballast is either pit-run or washed gravel, except in Colorado and Western Nebraska where smelter slag has been employed.

While the drop in elevation between Denver and Chicago is 4,600 ft., considerable adverse grade is encountered on this line, including one ascent of 1.3 per cent and another of 1.23 per cent in Iowa. Otherwise, the ascending grades are 0.8 per cent or less, while in Colorado and Nebraska there are long stretches of moderately descending grades. The line contains more than 500 curves, of which 84 are in excess of 2 deg. and 23 in excess of 3 deg., while sharper curves, including one of 12 deg. and a few ranging between 6 deg. and 7 deg. 42 min., were encountered in station limits and at the approaches to the Missouri and Mississippi River crossings. On the other hand, a considerable mileage of tangent track is embodied in the line, 257 miles of the total route distance being embraced in 14 tangents, including one of 43 miles, three of 20 to 25 miles, seven of 15 to 17 miles and three of 11 to 13 miles.

When this record run of the Zephyr was first proposed, 15 hours was tentatively set as the time necessary for its completion, but before fixing a schedule, a detailed study was undertaken for the purpose of ascertaining what the actual possibilities were. This gave rise to the development of a time-distance chart in which the capacity of the train's power plant, as determined by the manufacturers and verified in part by test runs, was analyzed for each mile of the line. In other words, the data as to the maximum speeds and rates of acceleration and deceleration were applied to the grades shown on the profile for the purpose of determining the time required to cover the various units of distance.

One further factor to be considered was the maximum allowable or safe speed, as controlled primarily by the relation of superelevation to rate of curvature, of all curves on the line, and the riding qualities of the train. One step in the development of this phase of the problem was the preparation of a table based on the physical characteristics of the train, showing the maximum safe speed, the "comfortable" speed and the mean of these two speeds for curves of various degrees and various superelevations. The other requirement, that of obtaining data on the actual curves on the line, was fulfilled by asking the division superintendents for information regarding all of the curves, showing the rate of curvature and the superelevation.

With this material on hand, each curve was checked against the table of safe speeds for the purpose of noting on the profile, at the location of each curve, the allowable speed at which the train could be run over that curve. The time-distance chart was then prepared with due al-

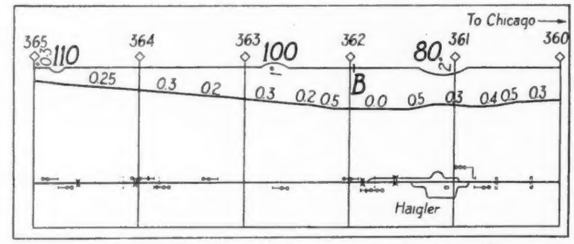
Log of the "Zephyr"
Denver to Chicago, May 26, 1934

Station	Mileage	Passing Time (Mtn. Time)	Min. from Previous Station	Average M. P. H.
Denver	......	5:05	......	......
Ft. Morgan	78.0	6:13½	68½	69.0
Akron	111.4	6:42	27½	75.0
		(Central Time)		
McCook	254.3	9:19	97	88.2
Hastings	385.6	10:57	98	80.4
Lincoln	482.6	12:12	75	77.5
Pacific Jct.	542.3	1:10	58	60.0
Creston	624.5	2:11	61	78.0
Burlington	811.9	4:38	147	76.2
Galesburg	855.1	5:15	37	70.2
Aurora	979.8	6:41	86	87.0
Chicago	1,015.4	7:10	29	73.8
Total trip	1,015.4	7:10	785	77.5

lowance for these limitations, and this showed that the anticipated time for the run could be reduced with safety from 15 hours to 13 hours.

Preparing for the Run

Having developed this information for the preparation of the tentative schedule of the streamlined train, the next step was to prepare a detailed schedule for the actual run. Instructions were issued to the divisions to supply data again for all the curves, but this time the figures as to superelevation were based exclusively on measurements taken in the field. The information thus obtained served as the basis for the speed limitations during the course of the trip. Comparing the field notes on degree of curves and superelevation with the table of speeds for



A Section of the Condensed Profile Used on the Trip. The Large Figures Indicate Speed Restrictions on Curves; "B" Indicates Location of a Speed-Limit Board

various rates of curvature and superelevation, the maximum allowable speed for each curve was determined and this figure was entered in red ink on the condensed profile, together with speed restrictions at five other local points where they were deemed necessary. This information having been collected, it was employed in the preparation of the final schedule for the trip. The profile became the guide for the engineers' maintenance of way in their duties as pilots on the run—not only to warn of the approach to curves with speed restrictions, but also to call attention to opportunities for increased speed on long tangents, descending grades, etc. As a further precaution, for every curve on which a speed of less than 95 m.p.h. was necessary, a special speed-limit sign was installed 3,000 ft. west of its west end, and to insure against any misunderstanding of the location of these posts, they were checked by the division engineers.

"Clear the Track"

Another important element in the plans for the record run embraced the measures taken to insure that the line would be cleared for the train well in advance of its arrival at all points along the line. The co-operation of other roads was enlisted to prevent the blocking of railroad crossings by their trains, and A. W. Newton, chief engineer, obtained the consent of the United States War Department to close the movable channel spans against river traffic, both in the Mississippi river at Burlington, Iowa, and the Chicago river, well in advance of the arrival of the Zephyr. But the precautions did not stop there. Signal supervisors were stationed in every interlocking tower to insure that the arrangements were understood by the towermen, especially those employed by foreign lines, and at all automatic interlocking plants flagmen were stationed on the opposing lines at sufficient distances to insure the stopping of trains outside the limits of the interlockings. In addition, motor boats patrolled the two rivers, both up and downstream from the bridges to warn the pilots of boats that the spans would not be opened.

Even greater stress was placed on the protection of highway and street crossings and no feature of the record run is of greater significance than the spirit of co-operation shown by the municipal officers, members of civic bodies and others in the towns along the line in providing officers to amplify the force of railway employes recruited to serve as watchmen, not only at the crossings, but also through station grounds, to the end that the crossings would be protected against the remotest chance of a highway vehicle getting in the path of the Zephyr, and that the half million people who turned out to witness the run would be kept at a safe distance from the track.

This entire force of watchmen and guards was organized and instructed with painstaking care. Flagmen provided with large stop signs were stationed at all crossings. At all public crossings not equipped with gates, steel fence posts were set up at each side of the tracks so that bell cord could be stretched across the highway for the purpose of shutting off movements across the track 20 min. before the train was due. The watchmen were also required to sweep out the flangeways shortly before the arrival of the train.

A difficult problem was also presented in controlling the crowds that gathered along the track in the towns along the line. Here men provided with special badges signifying their duties were assigned to patrol the station grounds, warning people to keep at a safe distance from the track. Still another precaution taken was to post guards on all overhead bridges to prohibit persons from standing on them during the passing of the train, to eliminate the possibility of malicious throwing of missiles on the track or the train. Similarly, guards were placed at the ends of all bridges of any length to keep off trespassers. By reason of these precautions, the run was completed without an accident of any kind.

As a final check on track conditions on the day of the run, one hour before the train was due each section foreman on double track ran his motor car over his section on the opposing track while inspecting the track on which the Zephyr was to run. On single track lines, patrolmen started out three hours before the scheduled arrival of the Zephyr and inspected the track over districts of 20 to 25 miles each, traveling from west to east.

Another special precaution was a bulletin to the track forces to avoid any work, such as tie removals, on May 26 that involved disturbance or obstruction of the track used by the train. All employes using motor cars were prohibited from using the regular car set-offs; they were instructed, instead, to place the cars on road crossings where they could be set back a greater distance from the track and securely anchored. Furthermore, no motor cars were permitted on the line after the final patrol inspection was completed.

Operating Arrangements

The operating plans for the run provided that train orders for the entire trip would be delivered to the conductors at Denver. All trains were required to clear for the Zephyr well in advance of its scheduled time. If trains were standing when met or passed, crews were instructed to inspect their trains to insure against any obstructions. Passenger train crews were cautioned to keep vestibules closed on the side next the eastbound track.

Three men took turns at the motorman's place in the cab, and each of these men during his tour of duty was assisted by one of four maintenance of way officers who occupied the seat on the left side of the cab, with a condensed profile of the line especially prepared for the purpose, as previously described. With the aid of the

data presented on this profile, this maintenance officer gave advance information to the motorman of the track conditions ahead, not only as to the approach to curves, but also as to the grades, lengths of tangents, etc., to the end that the latter could anticipate any action that it was necessary for him to take in controlling the speed of the train, as well as to take the fullest advantage of all opportunities to accelerate the speed. Obviously, this arrangement would have no place in the regular operation of high speed trains by enginemen possessing the requisite familiarity with their regular runs, but in this unprecedented non-stop run of 1015.4 miles, it comprised an essential element in the detailed plan that made for the success of this memorable feat in rail transportation.

Track Not Especially Prepared

One of the most significant facts in connection with this record breaking run is that the track was not subjected to any out-of-face improvement in preparation for it. It is true that some attention was given to surface and alinement, but this was limited to spot work done by the regular section forces and was confined largely to the checking of superelevation to insure that it was uniform throughout the length of each curve. The superelevation was increased outright on only one curve connecting two long tangents in a location that was specially favorable for the development of high speeds.

Typical Track View on the Route in Western Nebraska

While this epoch making run was planned and executed with extraordinary care, in so far as the track is concerned, the run from Denver to Chicago demonstrates that present-day track maintained to current standards of high grade workmanship, will suffice for the operation of trains at the super-speed, save for the establishment of certain refinements in alinement and special care in the maintenance of uniform superelevation on curves.

F. G. Gurley, assistant to the operating vice-president of the Burlington, was in general charge of all arrangements for this remarkable speed test, while H. R. Clarke, engineer maintenance of way, supervised the study of track conditions, including speed restrictions on curves, with the assistance of C. W. Breed, office engineer, who computed the safe speeds of the train for various rates of curvature and superelevation. Mr. Clarke, together with E. H. Piper and W. O. Frame, district engineers maintenance of way, and H. C. Murphy, superintendent of safety and formerly district engineer maintenance of way, served in turn as co-pilots in the cab of the Zephyr throughout the entire trip.

Rail Output Increases Slightly in 1933

THE production of rails in the United States in 1933 totalled 416,296 tons, which comprised a slight increase, 13,730 tons, as compared with 1932, but which, with the single exception of the previous year, represented the lowest output of rails since 1866, according to figures released by the American Iron and Steel Institute. The production of rails in 1933 compares with an output of 3,217,649 tons in the peak year of 1926 and of 1,157,751 tons in 1931. A substantial decrease, 61,084 tons, in the production last year of rails weighing 100 and less than 120 lb. per yd., was more than compensated for by an increase of 28,265 tons in the output

Production of Rails by Processes, Gross Tons, 1918-1933

Years	Open-hearth	Bessemer	Electric	Rerolled*	Total
1918	1,945,443	494,193	......	101,256	2,540,892
1919	1,893,250	214,121	50	96,422	2,203,843
1920	2,334,222	142,899	297	126,698	2,604,116
1921	2,027,215	55,559	5	96,039	2,178,818
1922	2,033,000	22,317	......	116,459	2,171,776
1923	2,738,779	25,877	118	139,742	2,904,516
1924	2,307,533	16,069	......	109,730	2,443,332
1925	2,691,823	9,687	......	83,747	2,785,257
1926	3,107,992	12,533	......	97,124	3,217,649
1927	2,717,865	1,566	......	87,055	2,806,486
1928	2,580,141	2,718	438	64,196	2,647,493
1929	2,626,163	3,486	723	55,766	2,722,138
1930	1,834,933	2,137	45	36,118	1,873,233
1931	1,145,551	813	15	21,372	1,157,751
1932	393,014	64	......	9,488	402,566
1933	397,792	300	......	18,204	416,296

*From old steel rails.

Production of Rails by Weight Per Yard 1918-1933

Years	Under 50 pounds	50 and less than 85	85 and less than 100	100 and less than 120	120 pounds and over	Total gross tons
1918	395,124	665,165	888,141	592,462		2,540,892
1919	263,803	495,577	965,571	478,892		2,203,843
1920	489,043	433,333	952,622	729,118		2,604,116
1921	211,568	214,936	902,748	849,566		2,178,818
1922	265,541	274,731	728,604	902,900		2,171,776
1923	272,794	300,907	864,965	1,465,850		2,904,516
1924	191,046	213,274	853,431	1,175,581		2,433,332
1925	163,607	219,648	765,371	1,636,631		2,785,257
1926	197,260	256,287	797,662	1,966,449		3,217,649
1927	161,836	173,257	539,445	1,314,424	617,524	2,806,486
1928	134,197	128,726	465,393	1,203,749	718,428	2,647,493
1929	141,362	102,944	409,628	1,233,599	834,605	2,722,138
1930	95,626	81,299	267,879	835,496	592,933	1,873,233
1931	50,089	25,524	123,398	495,753	462,988	1,157,751
1932	16,655	13,705	28,593	215,091	128,522	402,566
1933	*49,116	†15,413	40,973	154,007	156,787	416,296

*Under 60 lbs. per yd. †Sixty and less than 85 lbs. per yd.

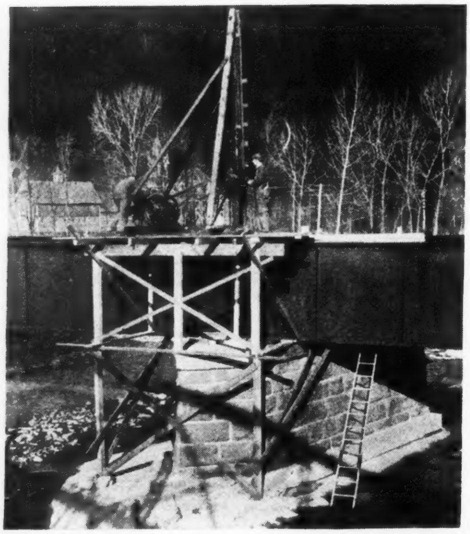
Production of Alloy-Treated Steel Rails, 1922-1933

	Total production.	Production by alloys		Production by Processes		Production by weight per yard				
Years	Gross tons	Titanium	Other alloys	Open-hearth and elect.	Bessemer	Under 50 lbs.	50 and under 85 lbs.	85 and under 100 lbs.	100 and under 120 lbs.	120 lbs. and over
1922	3,163	2,493	670	3,163	......	......	321	835	2,007	
1923	2,142	346	1,796	2,142	......	......	56	317	1,769	
1924	5,167	1,696	3,471	5,167	......	......	......	847	4,320	
1925	4,009	1,616	2,393	4,000	......	70	47	....	3,892	
1926	4,216	1,099	3,117	4,216	......	......	42	1,027	3,147	
1927	1,265	....	1,265	1,265	......	......	......	374	391	500
1928	6,453	3,711	2,742	6,453	......	29	......	879	1,652	3,893
1929	1,965	486	1,479	1,965	......	100	......	748	967	150
1930	4,687	517	4,170	4,687	......	146	......	885	1,137	2,519
1931	533	....	533	518	15	......	......	282	232	19
1932	565	....	565	565	......	......	......	75	490	....
1933	437	....	437	437	......	......	......	134	303	....

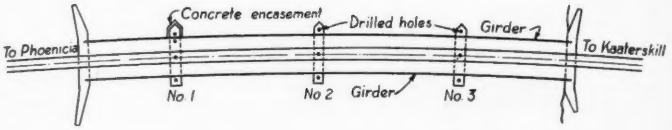
of rails weighing 120 lb. per yd. and over, an increase of 12,380 tons in the group weighing 85 and less than 100 lb. per yd., and an increase of 34,169 tons in those weighing less than 85 lb. per yd.

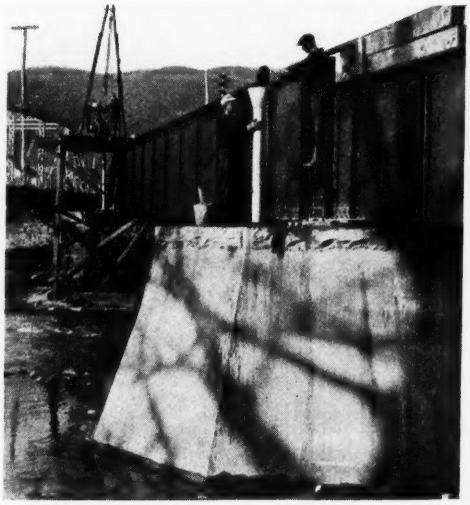
The production of rails rerolled from old rails amounted to 18,204 tons, as compared with 9,488 tons in 1932, while the production of alloy-treated steel rails showed only slight change, being 437 tons last year as compared with 565 tons in 1932. As usual, the production of Bessemer steel rails remained a negligible factor, amounting only to 300 tons. As will be noted by the second table a change has been made in the classification of rails weighing less than 85 lb. per yd.

Internal Grouting Restores Stone Masonry Piers



Experience has shown that old structures of stone masonry may become weakened due to the disintegration of the mortar and the consequent loss of bonding strength. When this happens the problem of adequate repair is always a difficult one. This article tells how the New York Central re-established the strength of three such piers by rebonding the interior material with cement grout.





Upper Left—The Six-Inch Shot Core Drill at Work at the Center Pier. Upper Right—Plan of the Bridge Across Esopus Creek Near Phoenicia, N. Y., Showing the Position of the Drilled Holes in the Piers. Lower Right—One Hundred and Sixty Bags of Cement in Grout Form Were Taken Up by Pier I, Which Was Also Partially Encased in Concrete

DURING the last few years the New York Central, Buffalo and East, has effectively re-established solidity and strength of several old stone masonry walls and piers by forcing rich cement grout into the interior of these structures through core drill holes put down through them from the top. In all cases, the old structures have been found to have a considerable proportion of internal voids, due, in some cases apparently, to disintegration of the lime mortar used originally in their construction and loss of this powdered mortar through the face joints. In most cases this condition has been evidenced but little on the surface.

One of the latest applications of internal grouting on the New York Central was on three old masonry piers of a single-track bridge on the Catskill Mountain branch of the road, formerly the Ulster and Delaware Railroad, which extends from Kingston, N. Y., on the main line of the West Shore Railroad, up through the Catskill mountains to Oneonta, N. Y., a distance of 107 miles. This bridge, which spans Esopus Creek at Phoenicia, N. Y., and several other bridges on this line, were damaged by flood conditions during August, 1933. At that time, following generally rainy weather, a 12 to 15-in. rainfall within a period of 24 hours, practically inundated the valley traversed by the railroad, washing out hundreds of feet of railroad and highway embankment and carrying away several highway bridges. The railway bridges withstood the test, except for the scouring action of the flood which undermined several piers and abutments to a considerable extent.

One Pier Damaged Quite Seriously

The bridge at Phoenicia is a single-track, four-span through plate girder structure, 245 ft. long, with the base of the track rails only about 12 ft. above the creek bed. The three piers and two abutments supporting the bridge are of coursed ashler masonry with a rubble interior, and were originally set up with lime mortar. The piers are about 8 ft. wide by 25 ft. long, and have a height of only about 9 ft. above low water. The total depth of the different piers is from 16 to 17 ft., the bases resting generally upon a foundation of red clay, underlaid with sand, gravel and boulders.

At the time of the flood in August, 1933, this bridge was practically inundated, the water rising to within a few inches of the tops of the girders. However, it held against the extreme water pressure and would have been little affected, but for the fact that several large trees lodged against the southerly pier, No. 1, and caused a swift undercurrent which scoured out the creek bed

around its base. As a result of this scour, the pier settled unevenly a few inches, and a part of its upstream nosing broke away. This condition was remedied quite readily by cribbing up the girders, underpinning the entire pier, and then completely encasing the upstream half with concrete. Later, the lowered spans were jacked up to proper level and given support on the pier, and the entire base of the pier was heavily rip-rapped as a precaution against further scour.

Core Drill Used To Produce Grout Holes

It was during the work on this pier and the strengthening of the base of the next adjacent, or middle, pier, that it became evident that all three of the piers were unsound internally. Investigation showed that the lime mortar used in the masonry had disintegrated, lost its bonding power, and to some extent at least, had worked its way out of the face joints, leaving a seamy, and anything but monolithic interior.

On Completion of the Grouting, all the Piers Were Re-Pointed

Little immediate concern was felt for the piers as a result of this condition because of the light traffic and light engines moved over the bridge, but it was decided to remedy the condition, as had already been done successfully in other cases, by forcing cement grout internally throughout the piers. Accordingly, late last fall, when traffic over the line had been reduced to the winter schedule of three trains a week, a shot core drill was moved to the bridge, and the piers were drilled vertically from the top to permit the application of the grout.

In this work, in which a 6-in. drill, driven by a single-cylinder 6-hp. stationary gasoline engine, was used, four holes were drilled in pier No. 1, the one damaged by the flood, and three holes were drilled in each of the other two piers. In each case the holes were drilled along the longitudinal center line of the pier, one hole at the center line of the track and the other holes directly outside the bridge girders, or generally 9 to 11 ft. from the center line of the track. The fourth hole in pier No. 1 was drilled just inside the west girder, 7 ft. 2 in. from the center line of the track, and was provided to insure complete grouting of that part of this pier which had been strained most severely by the high water.

In the case of each hole, the drilling was carried down to the pier foundation, and in several cases well into the foundation to ascertain its exact character. Each pier interior disclosed the same condition,—broken rock of various sizes, with many open seams which had at one time, undoubtedly, been filled with mortar.

All of the drilling was done from staging built either directly across the track or on the ends of the piers, in both cases supported at least in part by the bridge girders. The drilling of the holes at the ends of the piers did not interfere with the movement of trains, but since the drilling of the center holes blocked the track completely, these holes had to be put down on those days in which there were no train movements. As expected, the drilling involved little difficulty, except when seams were encountered, which was about every three or four feet. When these were struck, the steel cutting shot of the drill was lost, and then, before drilling could be resumed, it was necessary to close the seams with cement and allow it to set up.

The size and extent of the seams encountered, and, therefore, the general condition of the interior of the piers, is seen in the fact that the closing of the different seams required from 2 to 25 bags of cement mixed with water into a ready-flowing grout. This grout was merely poured into the holes through a section of galvanized sheet metal pipe with a funnel-like top, and allowed to diffuse itself throughout the interior by gravity and the weight of the grout in the supply pipe. After the grout poured to seal a seam had set up, drilling was resumed in the same hole, only to be stopped again a few feet lower down by another open seam, apparently not connected with the one sealed above. In each case grouting was resorted to until the drilling was carried down to the foundation. Upon the completion of each hole, the drill was withdrawn and the hole was filled with lean neat cement grout, and was kept filled at the top as the grout leaked out below into any remaining cracks.

Cement Used

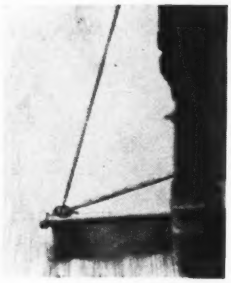
The extent of the voids in the different piers is seen in the final record of the work, which show that 160 bags of cement were used in grouting pier No. 1, 25¼ bags in grouting the center pier, and 57 bags in grouting pier No. 3. The amount of grout applied in each hole is given in the following table.

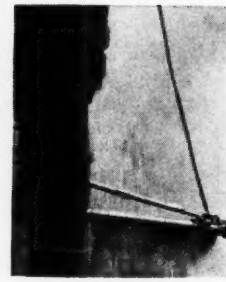
Drilling and Grouting Data

Pier	Depth of Hole	Cement Used (Bags)
1	16 ft. 5 in.	70
1	17 ft. 2 in.	27
1	16 ft. 2 in.	10
1	16 ft. 5 in.	53
2	16 ft. 1 in.	14¾
2	16 ft. 6 in.	6½
2	15 ft. 6 in.	4
3	16 ft. 0 in.	27
3	15 ft. 4 in.	9
3	15 ft. 9 in.	21

That there was general diffusion of the grout throughout the piers is evidenced not only in the quantity of grout injected, but also in the fact that the grout reached the face of the masonry at many joints, which had to be calked to prevent its waste. After the internal grouting was completed, all three of the old piers were repointed and thus left in first class condition.

The internal grouting of the piers was done with a force of three men, including a driller, a gas-engine operator and a mason helper, and required a total of approximately 38 working days, 31 days of which were employed in the actual drilling and grouting operations, and 7 in building and moving staging. The work was carried out under the direction of J. H. Kelly, division engineer, assisted by J. K. Bonner, supervisor bridges and buildings, and W. E. Malott, general foreman of drillers.





The Oil Spray Car, Spray Pipes in Action on the Right and Left

Making Track Dustless

The Chicago & North Western has adopted a new method for applying oil to its roadbed to keep down dust, which reduces the oil consumption by one-half as compared with gravity applications. The features of this method include the injection of live steam into the oil, high-pressure delivery to the spraying outlets, a complete atomization of the oil at the moment of application and close control of the dosage.

WITH the aim of increasing the comfort of the millions of commuters who patronize its suburban service in the Chicago area, and that of the passengers on its through trains between Chicago and Omaha, Neb., and between Chicago and the Twin Cities, the Chicago & North Western last year revived with better results, a practice which it had abandoned some years ago, of oiling its roadbed to keep down dust. While the oiling of track is not new, the methods now being employed by this road are of particular interest, since the oil is delivered to the outlet orifices at a temperature of about 200 deg. and a pressure of 200 lb., where it is atomized into a fine spray. By this method, a satisfactory blanket of oil on the ballast is obtained with about one-half the minimum volume of oil usually required when the application is made by gravity. A secondary benefit which was not considered seriously when working out this method of application is that the growth of vegetation within the limits of the application is definitely retarded.

The oiling is not confined to any one type or grade of ballast, the need for oiling any stretch of track being determined solely by the amount of dust raised by trains. In the main, however, the applications made last year and those scheduled for this year are on tracks ballasted with gravel. The North Western has a relatively large mileage of tracks ballasted with crushed stone which, when first applied, is practically dustless. The lines of this road pass through a highly developed agricultural territory, however, and at certain times of the year considerable dust is blown onto the tracks from the plowed fields. While the volume of dust thus brought in does not foul the ballast sufficiently to interfere with drainage until after many years, it is sufficient to cause considerable discomfort to passengers after the ballast has been in service for a time.

For this reason, the schedule for oiling includes a large part of the rock ballasted tracks, although a measurable mileage of this type of ballast is not being oiled. These considerations affect the oiling schedules on the suburban territory, as well as out on the line, although the source of the dirt is different in the metropolitan district.

Last year, the oiling schedule covered about 2,000 miles of tracks between Chicago and Omaha, and Sioux City, between Chicago and Minneapolis, Minn., and in the lake resort district of Wisconsin, including the suburban lines at Chicago. This year, substantially the same territory will again be covered, and the schedule has been expanded to include an additional 400 to 500 miles between other points where it is considered that the volume of passenger traffic warrants the expenditure.

Ordinarily, owing to spring and early-summer rains, dust does not begin to be troublesome until after the middle of July. Furthermore, it is preferred to complete the season's program of tie renewals before any oiling is done, to insure the minimum amount of disturbance of the oil blanket as a result of maintenance operations. The extreme dry weather this year has created so unusual a situation, however, that the oiling schedule has been advanced several weeks. As a result, the oiling of the suburban tracks was completed the first week in June and the car was placed in operation out on the line about the middle of the month.

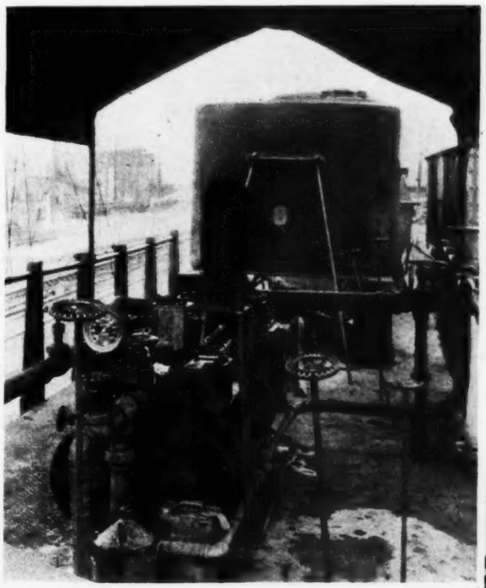
In general, the plan of operation calls for covering the entire ballast section and a strip of the roadbed one foot outside the ballast toe line with a blanket of oil.

This gives a width of 13 ft. on single track and of 26 ft. on double track. This year, however, because of the observed effect of the oil on weeds, an independent spray pipe has been provided on one side of the oiling car for the purpose of extending the application to the shoulder of the roadbed over those sections where weeds of the type that are killed by the oil are most troublesome.

A number of years ago when the North Western was using a bank-run gravel of poor grade as compared with the ballast it is now using, it oiled its roadbed regularly. The grade of oil then available was not entirely satisfactory for this purpose, however, since it required so heavy a dosage that there were disadvantages in its use. For this reason, and because it was beginning to install stone ballast on parts of its important passenger lines, the practice was discontinued. With the development of a better oil for the purpose, and because the deficient rainfall of the last three or four years has aggravated the dust problem, it was decided to resume the oiling of the track last year.

Oil With Heavy Asphaltic Base Selected

Road oil containing about 65 per cent of asphalt, which is largely residue from the refinery stills, has been found to give the most satisfactory results. Lighter oils or those with a lower asphalt content do not form the tough, rather elastic, blanket which is necessary to keep the dust down. It has been found that where lighter oils are used, it is possible to secure a somewhat deeper penetration in the ballast, particularly if the dosage is heavy, but that the oil coats the particles of ballast individually rather than forming a blanket. The result is that the air currents created by the passage of the train pick up the detached oil-coated particles, much to the detriment of passengers' clothing. It was for these reasons that oil having a heavy asphaltic base was selected to keep down the dust.



Above—Oil Pump, with Sand Tank in the Background. Right—The Oil Completely Blankets the Ballast

Gravity applications of oil of this grade range from 600 to 1,200 gal. to the track mile. The heavier dosage is used for the first application and the amount is reduced in subsequent years, although some roads make an initial application of not more than 600 to 700 gal. with apparently satisfactory results. During 1933, the North Western applied an average of 301 gal. to the mile over a territory aggregating approximately 2,000 miles. Although the results were satisfactory in the main, close observation has led to the decision to increase this to 350 gal. to the track mile. For experimental purposes, this latter quantity was used on certain sections last year, and it is believed that the better results justify the cost of the additional oil. It was found that, while the lower dosage could be relied on to keep the dust down so long as the surface remained unbroken, the additional 50 gal. tended to give a film of greater durability and uniformity, with practically no weak places to be broken by the suction of the trains. As a matter of fact, test stretches were oiled with quantities ranging from 250 to 450 gal., and it was found that the balance between cost and effectiveness occurred at about 350 gal.

It has been the custom for a number of years on the North Western to oil the rail joint fastenings, special equipment for this purpose being owned and operated by the road. The performance of the equipment for oiling the track proved to be so satisfactory last year that during the winter the car was equipped with spraying nozzles for the purpose of oiling both the rail and fastenings. While this attachment has not yet been tried out in service, preliminary tests have indicated that it will work satisfactorily. The spraying of the entire rail will increase the consumption of oil, as compared with oiling the joints only, but this will be more than offset by the fact that it will be done in connection with the oiling of the roadbed, thus eliminating the cost of operating the joint oiler independently. In addition, there will be a direct benefit in the protection of the rail and all fastenings against corrosion.

Two methods have been used for applying oil to the roadbed—by gravity and under pressure, the former being the older and more generally used method. When applied by gravity, owing to the high viscosity of oil having a large asphaltic content, it is necessary to heat the oil to insure that it will flow freely through the small outlet orifices that must be used to control the dosage. Even when heated, it is sometimes necessary to apply a pressure of from 5 to 15 lb. to insure a uniform flow.

Pressure Delivery and Injection of Steam Essential

For several years the Northern Pacific has been applying oil to its roadbed under heavy pressure, with results comparable to those from gravity applications, but requiring a smaller quantity of oil per mile. The officers of the North Western made a study of this method and finding it to be giving satisfactory results, constructed

the necessary equipment which, with a few modifications, is the same as that used on the former road. The essential features of the method are that the oil is preheated in the tank cars to a temperature of 200 deg. and forced to the outlet orifices under a pressure of about 200 lb. A fundamental step in the process is that steam at locomotive boiler pressure is mixed with the oil as it is discharged from the pump and again immediately before it is discharged through the spray pipes, to increase the spraying effect and thus give a better distribution over the surface of the roadbed.

In design the equipment is simple, and every precaution has been taken to insure its dependability. A duplex steam pump having a 4-in. suction and a 3-in. discharge is mounted near the center of a flat car, the suction end of the pump being connected through a 4-in. hose to the outlet opening of the tank car from which the supply is being taken, and which is coupled directly to the spray car. The discharge line from the pump is turned down through the floor of the car within the space required for the necessary fittings to connect it to the discharge opening of the pump.

Below the body of the car, the 3-in. discharge line from the pump is connected through a tee into a 1½-in. distributor pipe. As the oil leaves the pump it encounters a ½-in. open-end high-pressure steam line, through which steam at boiler pressure is injected into the stream of oil in the direction of flow. Inside of the distributor pipe there is a second ½-in. pipe with fully open ends, which is also connected into the main steam line serving the pump. This pipe, therefore, injects additional steam at boiler pressure and temperature into the stream of oil as it passes through the distributor pipe. By means of these two jets, the steam and oil are mixed very thoroughly and the temperature of the oil, already heated, is raised to a still higher level. While it is intended to inject the steam into the oil without restriction, the volume of steam is subject to manual control by means of a valve in the delivery line, which can be partly closed if this becomes necessary, as when the train must be operated below normal speed when slowing down to enter a siding.

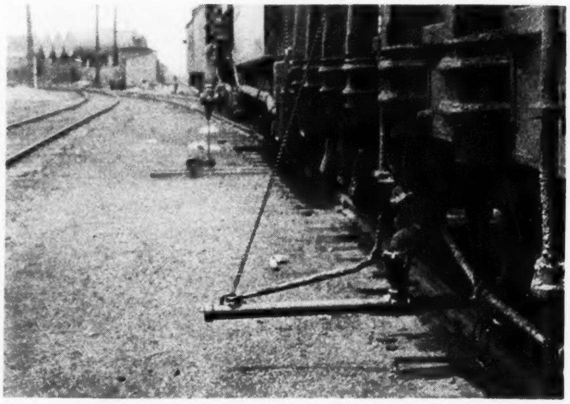
Oil Is Atomized into a Fine Spray

From the distributor pipe, the mixture of steam and oil passes through suitable connections to the spray pipes, which are set as low as clearance regulations permit. The set of sprays for the roadbed consists of three independent pipes, one of which covers the area between the rails, and one on each side which extends from the rail to one foot outside of the ballast toe line. Each of these three pipes is provided with a single line of drilled perforations 3/32 in. in diameter, spaced 1 in. apart in the section between the rails and at ½-in intervals in the outside sections.

In the preliminary tests it was found, and this has been confirmed in regular operation, that if holes of this diameter are provided, the mixture of steam and oil, when delivered at a pressure of approximately 200 lb., is completely atomized without the use of spray nozzles, although the area covered by the individual sprays is not so great. This has been easily overcome, however, by the close spacing of the outlet holes. In operation, the line of perforations is on the underside of the pipe so that the streams of atomized oil are directed vertically toward the ballast.

The injection of steam into the oil as it emerges from the pump and again immediately before it reaches the discharge openings is an essential element in the formation and continuity of the spray. Even when the oil is heated and delivered under the high pressure of 200 lb., it does not spray well until the steam is injected.

By setting the spray pipes as low as regulations permit, and then directing the spray vertically toward the ballast, the effect of the wind or other air currents on the atomized particles is reduced to the minimum, but certain precautions have been found necessary. At times enough of the fine spray is blown onto the running surface of the rail to affect the adhesion of locomotive drivers. To overcome this trouble, sheet metal guards have been provided to intercept any oil that may be blown toward the rail.



Outside Spray Pipe in Position for Oiling Shoulder

While these guards generally afford the required protection, oil is occasionally blown around or under these shields by strong gusty winds. Shields of sufficient size to afford complete protection for the rail under this condition would, of necessity, be so large as to be unwieldy, while it would also be necessary to extend them below the prescribed clearance limits. To overcome this difficulty, which occurs only occasionally, the oil car is equipped with a tank containing about 2 cu. yd. of locomotive sand which is applied to the rail in the event that any of the oil gets onto the running surface.

A speed of about 11 miles an hour is maintained during the oiling operation, so that a 10,000-gal. tank, which will cover about 28 miles of roadbed, is emptied in slightly more than 2½ hr. of continuous operation. A sufficient number of tank cars, last year this was usually three or four, depending on their capacity, are incorporated in the train when it starts on its day's run. This year, however, the consumption of oil is considerably greater, since application is being made to the rails and fastenings and at certain places to the shoulder of the roadbed.

It requires some time to heat a tank car of oil to 200 deg., for which reason two cars are kept on steam all during the night prior to their use. The car from which the oil is to be taken first is coupled next to the spray car and is held on steam from the locomotive while it is being emptied. Likewise, the second car is kept heated during this time. As soon as the first car is emptied, it is switched out at the nearest station, and the second car is brought up to replace it. The steam connections are then changed so that this car and the one next in order will be heated while the spraying operation is being continued. In other words, steam heat is always being applied to two oil cars during the progress of the oiling.

It is the common experience that oil of the type used on the roadbed contains a certain amount of sludge and foreign matter which tend to clog the pipes. The North Western has not escaped this difficulty, and has found

it necessary to blow out the distributor and spray pipes as often as six to seven times a day. To facilitate doing this, the pipes are fitted with screw caps which can be removed quickly to provide access for this purpose.

When the plan for adopting this method of oiling the roadbed was under discussion, it did not occur to any of the officers interested that it would have any weed-killing properties. As the season advanced, however, and the mileage of oiled track increased, it was found that the growth of all of the vegetation with which the oil had come in contact was being retarded, and that certain kinds of weeds, notably the troublesome horsetail, had been killed outright. As a result of this discovery, a spray pipe, perforated to oil a four-foot strip outside of the toe of the ballast section, has been added to the car. This is used largely on rock ballast which does not require oiling, but where it is desired to oil the shoulder of the roadbed to allay dust and to kill vegetation. It is not intended at this time to make this application general, but to spray the roadbed only where weeds of the kinds that are known to be killed by the oil, have gained a foothold. Where shoulder oiling only is done, the oil consumption is at the rate of about 215 gal. per mile.

It has already been mentioned that the method employed on the Chicago & North Western was derived from that which has been followed for several years by the Northern Pacific and that the equipment is a modification of that in use on this road. Considerable experimental work has been necessary, however, to adapt both the method and the equipment to the needs of the North Western. This work and the design of the oiling equipment has been done by C. E. Miller, supervisor of scales and work equipment, under the general direction of C. T. Dike, chief engineer, and J. A. Peabody, engineer maintenance of way.

What Makes a Good Foreman?*

By E. J. BAYER

Assistant Division Engineer, Peoria & Eastern, Danville, Ill.

WHAT makes a good foreman? In order to answer this question I have selected seven words which, in my opinion, are the foundation stones upon which a successful career as a foreman rests.

The first word is *fairness*. A sure way of gaining an unsavory reputation with the gang for this essential qualification is to show favoritism to certain members of the gang, or to take out on the men a grouch due to conditions over which they have no control. Factors such as these lead to dissension in the gang and cause the men to lose confidence in their leader.

The second word is *observation*, which is the art not only of seeing something, but also of retaining those pertinent facts which are necessary for immediate or future use. Observation is not an inborn trait of man, it is the development of one of the faculties and is acquired only through constant application to the details of seeing. For example, if we take two men—one inexperienced and the other experienced in track work—and show them a piece of track with good surface but with swinging ties and ask each for his opinion, the inexperienced man will say it looks good, while the experienced man will say, "It looks good, but has ties that are swinging." In the first instance we have seeing; in the second, observation. A large part of the knowledge and experience used in any line of endeavor is gained through observation and the man who sees but heeds not is doomed to failure.

The third word is *reliability*. To say that a man is reliable refers not only to his moral qualities, but also to his judgment, knowledge, skill and habits. A man who handles the truth lightly and has no compunction about twisting facts so that they appear to his advantage is lacking in the moral qualities which are essential to good leadership. Confidence in a man's judgment, knowledge and skill may suffer through lack of confidence in his truthfulness, for they are all linked together.

The fourth word is *energy*, which in the foreman is the creative force that co-ordinates the efforts of the men and produces specific results. Energy as it is manifested in a man of the nervous type is applied in such a way that little good is accomplished, or that any result gained is at the expense of excessive effort on the part of others. Men of this type are also inclined to be erratic in judgment as they do not possess the ability to concentrate upon the problem at hand.

Energy in the desired form is that subtle power which causes men with whom it comes in contact to strive to do their best, for they know that the energy which they themselves are expending is not being wasted and that they are accomplishing a desired result in an effective manner. Men have confidence in a man possessing this quality because they respect his judgment and know that he knows his job and produces results.

The fifth word is *management*. A man who is a success in any line of endeavor is always a manager. He not only makes use of his power of observation but plans his work in such a manner as to secure the best results with a minimum expenditure of energy and material. The man who is a real manager has his work planned days or even weeks ahead, and if conditions arise which necessitate breaking into his preconceived course of action, he takes care of the emergency and then returns to his original plan. The man with a plan may not appear to be busy but he is really accomplishing results.

The sixth word is *adaptability*. This characteristic is the ability to adjust one's self to conditions as they arise and to work out a solution for the problem that has arisen. There are many who are able to carry out a certain procedure if it follows along familiar lines, but are hopelessly lost if any variation occurs that calls for a different course of action.

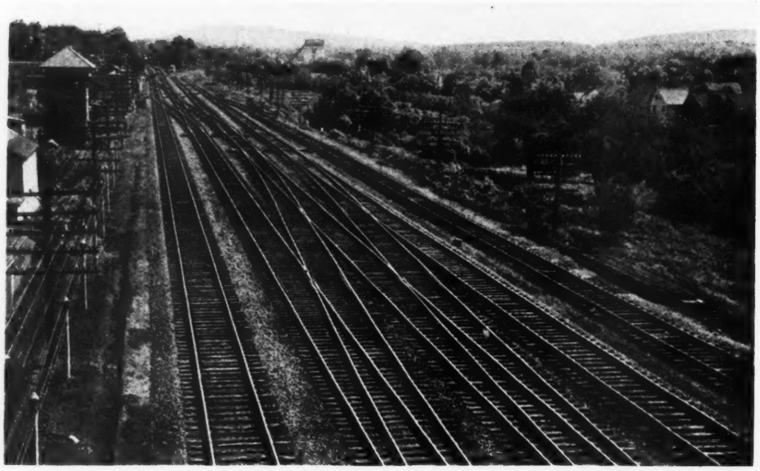
Another essential for this trait is the ability to adjust one's self to the different types of men and to be able to explain or show them the proper method to be followed in order to gain results. No two men are alike in their powers of conception and as a result it is necessary that the leader be able to judge the type and character of the men and issue his instructions accordingly.

The seventh and last word is *neatness*. A person who is neat in his own personal appearance ordinarily carries on his work in a like manner. The man who disregards neatness never finishes his job, for the cleaning up after a job is completed is just as important as the actual work necessary. Neatness may not actually improve the quality of the work done but it certainly does improve appearances, which is an important factor with patrons and does not go unnoticed by the man's superior officers.

When, therefore, you think of the word "foreman" with its seven letters, remember that the

F stands for Fairness
O for Observation
R for Reliability
E for Energy
M for Management
A for Adaptability, and
N for Neatness.

*Abstract of a paper read before a meeting of the Association of Maintenance of Way Foremen of the Cleveland, Cincinnati, Chicago & St. Louis, at St. Louis, Mo.



Looking East Over the East Half of the Erie's Made-to-Order Track Layout

Plan used in rebuilding 2,000 ft. of four track line, including eight crossovers, simplified installation and resulted in economies

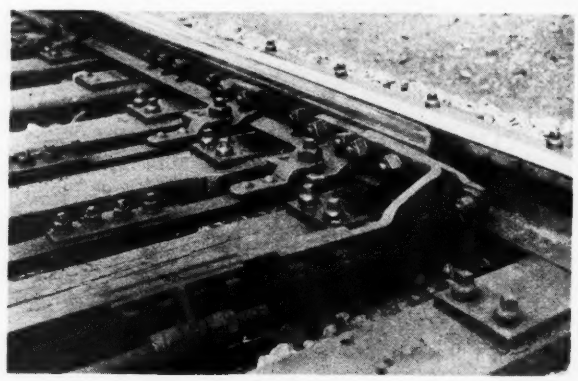
This Track Layout Made to Order

AN interesting example of the advantages and economy of made-to-order and carefully executed trackwork installations, especially where traffic is heavy and where many units of special trackwork are involved, is presented in work completed late last year on the Erie at Ridgewood Junction, N. J., where approximately 2,000 ft. of four-track railroad, which included eight No. 20 crossovers and one No. 10 turnout, was completely relaid with heavier steel, with no delays to trains, and with practically no waste of man-hours or materials. The outstanding features of this work were that the entire new layout was detailed on plans, even to the lengths of the individual rails and the locations of all rail joints, and that in accordance with these plans, all special length rails, totaling 155, were cut and drilled in a shop and distributed in the field exactly where needed.

Other features of interest were the use made of Samson switches, with their broad A-shaped points and specially under-cut stock rails, and the symmetry of the crossover layout employed, which reduced to a minimum the number of odd length rails required and the number of emergency undercut stock rails which it will be necessary to keep on hand. The use of long guard rails to protect stock rails from excessive wear, particularly on the trailing end of crossovers, was another feature. These guard rails were adapted to and used in conjunction with the heavy adjustable rail braces of the switches.

Old Track Practically Rebuilt

This layout included approximately 2,000 ft. of four-track main line just east of Ridgewood, N. J., and immediately west of the junction with the road's two-track Bergen County freight line leading to its extensive freight facilities serving the New York Metropolitan area. Within this territory there were 16 No. 20 turnouts in eight crossovers and one No. 10 single turnout. All of these were used frequently and were equipped with power-operated switches controlled in an all-electric interlocking system.



Close-Up of One of the A-Shaped Samson Points, Showing How the Recess in the Stock Rail Houses the Point

The tracks within the area affected were laid with 100-lb. R.A. rail on stone ballast. The rail, which had been in service from 8 to 12 years, was fitted with 24-in., 4-hole 100 per cent joint bars. All turnouts were likewise of 100-lb. material, with standard knife-edge switch points. This entire layout had been maintained to a satisfactory standard, but with the realization that maintenance costs were abnormally high, owing to the fact that the ballast required cleaning, that tie renewals were in order, and that much of the rail had reached the limit of main-line life, it was decided to rebuild the entire layout to the present main-line standard of the road. In doing this, new 130-lb. rail with 100% headfree joint bars was laid on new heavy plates, lagged to the ties, the main line standard track of the Erie being employed throughout; cross and switch ties were renewed where required, including all of the switch ties ahead of the heel of switch at each turnout; the ballast was cleaned, including that in the

Right—All the New and Old Frogs Were Handled With a Locomotive Crane

Left—All the Trackwork Was Done Without Making a Single Cut of the New Rail in the Field

tie cribs; and the entire track layout was raised and resurfaced on about three inches of new stone. In addition, all 17 new switches were laid out in accordance with Erie standard plans and were located so that adjacent crossovers would be a definite distance apart. The units of special trackwork used in all turnouts included the Samson switch points, 30 ft. long, and rail-bound manganese insert frogs, 29 ft. long.

Detailed Plans Prepared for Layout

In view of the magnitude of the field work, which it was realized this project would involve if all of the adjustments and rail cuts were made in the field as encountered, and especially in view of the 40 or more important passenger train and 18 or more important freight train movements through the territory between 8 a. m. and 8 p. m. daily, it was decided to design the entire layout on paper and to ship all materials to the job ready for installation.

In carrying out the plan, the first step taken was to make a detailed field survey, from which a large-scale plan of the tracks was prepared. On this plan the new arrangement of crossovers was plotted, with the specific location of every rail joint and the length and position of every rail of other than 39-ft. length. In this preliminary work, advantage was taken of the opportunity to move the crossovers slightly to minimize the number of short rails necessary between them, although the standards for rail lengths and location of insulated joints in crossovers were observed exactly.

Care was taken that the short rails found necessary were such that they could be cut from available lengths with a minimum of waste. By using standard No. 20 turnouts, the rails of any of the nine left-hand turnouts are interchangeable with those of any of the other left-hand turnouts, and the same situation applies with respect to the eight right-hand turnouts. Furthermore, by standardizing the distance from the switch points to the forward ends of the stock rails, only four emergency specially under-cut stock rails are required to be kept on hand to protect all 17 turnouts, two for the left-hand turnouts and two for the right-hand turnouts.

All Short Rails Cut at Shop

Following the preparation of the track plan, on which all special or short rails were given specific numbers, the plans were submitted to the Ramapo Ajax Corporation, the builder of the special trackwork, as a guide in furnishing the layouts desired. Another reason for submitting the plans to this company was that arrangements were made to have it cut to length and drill all short rails required in the entire layout, the rail itself being furnished by the railroad. To minimize waste in making the rail cuts, a list was compiled of all short length rails required and this was checked against shipping notices of new rail. The short rails available were thus determined and diverted directly to the frog shop. From these, the short lengths desired were cut to the best advantage, as determined in advance and designated on plans, and were drilled for the new 39-in., six-hole headfree bars to be used in the new track assembly. After being sawed and drilled, which work was done with power saws and drills, the appropriate plan numbers were both stamped and painted on the webs of the different rails, and eventually the rails were carefully loaded into cars in the order opposite that in which they were to be distributed along the tracks.

With suitable markings on the old track rails to indicate the points for unloading the short-length rails, these rails were set off exactly where needed and the gaps between

them were filled out with standard 39-ft. rails. The switch material was also unloaded as near the point of installation as possible, so that a minimum of handling of any of the material was required after the track was cut in preparation for relaying.

Perfect Fit Secured in Field

The new track material was set in place with a locomotive crane, one track at a time, the tie plates being renewed and the turnouts changed out as they were reached. None of the work was done under traffic, as

Looking Across a Number of the No. 20 Turnouts

it was always possible to arrange with the operating department, which co-operated to the fullest possible extent, to take a specific turnout or short section of track out of service during certain hours of the day. Where passenger movements were involved, it was usually about 10 a. m. before a turnout could be secured, but where only freight movements were involved, it was generally possible to get a section of track as early as 8 a. m. In all cases the track had to be returned to service between 2:30 and 4 p. m., depending upon traffic conditions.

One of the 20-Ft. Rail-Bound Manganese Insert Frogs Employed Generally in the Layout

In connection with the renewal of the switches, the head blocks were renewed, as well as all switch ties through the heel of switch, treated oak being used in both cases. This was desirable to accommodate the new switch plates, and to obtain proper adjustment of the switches. All interlocking work was carried out simultaneously with the switch work so that when a turnout was turned back to the operating department it could be placed in unrestricted service.

As was expected in view of the careful advance preparation, the new trackwork was brought together without difficulty, one or two turnouts being put in each day worked, depending upon the amount of time available and the amount of intermediate rail laid. Not a single misfit was encountered in the entire work and not a single rail was cut in the field. As a result, much time and labor were saved in laying the new steel, serious traffic interruptions were avoided, and there was a considerable saving in material. Furthermore, as a result of the preliminary planning, a carefully redesigned layout was afforded which is best suited to the train movements called for, and, at the same time, one which, because of its symmetry, requires the keeping of a minimum number of spare rails on hand for purposes of renewal.

Following the completion of all of the rail and switch renewal work, special gangs removed the old ballast from between the ties, respaced and renewed ties where necessary, and then cleaned all of the shoulder and intertrack ballast to a depth of 12 in. below the bottom of the ties. The latter work was done by a locomotive crane in conjunction with a screen mounted on a low-side

One of the No. 20 Turnouts Showing the A-Shaped Samson Points and Recessed Stock Rails

gondola car, the cleaned stone being made to fall back into the tie cribs. The sub-grade outside the ballast shoulder was cut down and widened to Erie standards and standard ditches provided. After this was completed, four standard lag screws, with double coil washers for holding the tie plates to the ties, were applied per tie, pneumatic tools being used for the purpose. Later, additional stone ballast was plowed over the tracks and they were given a minimum out-of-face raise of three inches.

All of this work was carried out under the general direction of J. C. Patterson and I. H. Schram, chief engineer maintenance of way, system, and engineer maintenance of way, Eastern district, respectively, and under the immediate supervision of F. S. Wheeler, division engineer, and A. E. Kriesien, assistant division engineer at the time, but now transportation inspector, operating department.

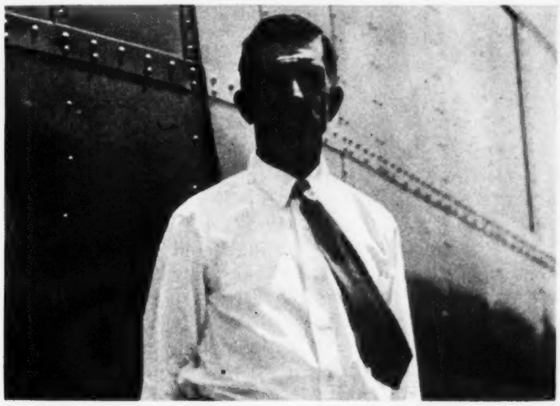
Dressing Ballast Behind a Surfacing Gang on the Erie

Safety Record Wins Honor for Section Foreman

IN all of his 39 years as a section foreman, Jerome Mauk of the Union Pacific has never suffered a personal injury nor have any of the men working for him been injured. Proud as he is of his safety record, Mr. Mauk never expected to receive nation-wide prominence because of it, that is, until he received a telegram while on duty that was to result in his being honored in a most unusual and distinctive manner. It happened this way.

The American Museum of Safety was preparing to make its annual presentation of the E. H. Harriman Memorial awards to the three railroads having the best safety records for 1933 in their respective groupings. In this classification the railroads are divided into Groups A, B and C, according to the number of locomotive-miles operated. The winner in group A is awarded a gold medal, that in Group B a silver medal, and in Group C a bronze medal. For 1933 the winners were the Union Pacific in Group A, the Duluth, Missabe & Northern in Group B, and the Chicago & Illinois Midland in Group C.

As is the usual practice, the plan was to present the medals to representatives, preferably the presidents, of the three railroads at a luncheon at the Union League



Jerome Mauk, All-American Safety Foreman

Club in New York. This year, however, when analyzing the safety accomplishments of the railroads in the various groups, the Committee of Award was particularly impressed with the "many splendid records that had been made by those loyal and conscientious leaders out there on the firing line—the gang foremen." Desiring, therefore, to give public recognition to the part played by the section foreman in establishing safety records, this committee decided this year to deviate somewhat from the established practice. Accordingly, it asked the Union Pacific to designate that system's senior safety veteran and to have him present at the luncheon. With 50 years of service with this company and with a record of 39 years as a section foreman without a personal injury, Mr. Mauk was chosen for this honor.

When notified by wire that he was wanted in New York, Mr. Mauk barely had time to change his clothes before catching a train for the East. At the luncheon he was introduced by Carl Gray, president of the Union Pacific, and was designated by the committee of award as the "all-American safety foreman." Mr. Mauk received these honors gracefully and all those present were impressed by his rugged personality.

Jerome Mauk, who is 65 years old, was born at Glasgow, Ky., the son of a farmer who took up a homestead near Asherville, Kan., in 1872. Mr. Mauk entered the service of the Union Pacific 50 years ago and for 11 years he worked as a trackman. He was then promoted to section foreman at Talmo, Kan., where he remained for 35 consecutive years. Four years ago he was transferred to Belleville, Kan., where he is now located.

Employment Up 13.75 Per Cent in May

DURING the month of May, 30,214 more persons were employed in maintenance of way work on Class I railroads than in May, 1933. Last year the total force was 197,171, while in May this year it was 227,385, an increase of 13.75 per cent. While no corresponding figures for the use of maintenance of way materials are available, estimates, based on a careful analysis of data obtained from a large number of roads indicate that the value of all materials, except fuel, purchased by the railroads of the United States during the first five months of 1934 was $225,000,000, compared with $95,000,000 for the same period in 1933, or an increase of 137 per cent. It is obvious, of course, that the purchases made to meet the requirements of roadway and structures comprised an important factor in the development of this large increase in the outlay for materials. Thus, the value of rail received by the railroads during the first three months of 1934 was $14,400,000, compared with $2,970,000 for the first three months of 1933 and $9,250,000 for the first quarter of 1932. Similarly, the outlay for ties in the first quarter of this year was $14,031,000, the corresponding figures for 1933 and 1932 being $8,260,000 and $12,700,000, respectively.

No small part of the increase in the activities of the maintenance of way department was made possible by the Public Works Administration which has allotted $199,607,800 for work-creating loans to the railroads, of which more than $40,000,000 is for roadway and structures. According to a statement issued by the P. W. A., rail purchases financed with federal money represent an outlay of $14,689,987, those for rail fastenings other than spikes total $3,504,575, and "switches" $656,254. It is said, also, that 30 per cent of the "track" forces of 11 railways, or 20,325 men, were employed on P. W. A. loan improvements. As a specific example, the Southern Pacific, which obtained a loan of $6,771,985 for work on roadway and structures reported on May 15, that it had a force of 5,467 men engaged in rail and tie renewals and bridge and trestle work, made possible by this loan. The corresponding force on the Great Northern is 4,266 men and on the Boston & Maine, 1,355 men.

However, the increased activity in the maintenance of way department is not solely the result of the impetus given it by loans from the federal government. In the first place, the federal funds made available for this purpose represent only about 12 per cent of the total outlay for maintenance of way structures last year. Furthermore, a check of the purchases of 48 roads for the first quarter of 1934 shows that while 30 roads that had received P. W. A. loans increased their purchases by 32 per cent over that for the first quarter of 1933, 18 roads that had not borrowed any money had increased their first quarter expenditures, 47 per cent.

With the increase in railway earnings, the tendency is to place greater dependence on corporate funds, rather than government loans. However, the P. W. A. has continued to make allotments to the railroads, including two

to the Gulf, Mobile & Northern, namely, one of $185,000 for the purchase of rail and a second of $31,000 for the labor required to place it in track.

While no large orders for rail were placed during the last month, a canvass of rail orders placed during the last six months has brought to light a number of small orders that aggregate some 20,000 tons, which, added to the purchases of 41 roads previously reported, brings the total to about 654,000 tons. It is to be expected, however, that the actual total is in excess of this figure because all of the orders placed have not been made public. Furthermore, because some railways have issued shipping instructions on tonnage reservations made prior to October 1, 1933, it is to be expected that the tonnage of rails laid during the present season will exceed the aggregate of the tonnage ordered since that date.

It is of interest to note that out of $199,607,800 that has been allotted to the railroads, only $43,590,000 had been distributed in cash remittances up to the middle of June. This is in accordance with the plan of disbursement adopted, whereby checks are drawn as the money is spent, for either wages or for materials delivered.

Track Circuits Without Bonds on the Katy

SOMEWHAT by accident the Missouri-Kansas-Texas discovered that satisfactory operation of track circuits may be obtained without the use of bonding wires at joints and, as a consequence, this company has not installed bonds for track circuits on any new rail since 1927. As a result, 125 miles of track in automatic signal territory are now in service without bonds. In this territory responsibility for maintaining a sufficiently low electrical resistance in the rail joints to carry the track circuit lies with the track department, which has developed and brought into use certain practices and methods of joint maintenance that are calculated to insure satisfactory operation of the track circuits.

The practice of eliminating the bonding of rail joints originated on the Katy in 1926 when new 90-lb. rail was laid on 23 miles of block signal territory between Hewitt, Tex., and Temple. As the improvement program in this territory called for the raising of the track and the installation of additional ballast it was decided to postpone the bonding of the rail until the track work had been completed, in order to avoid damage to the bonds. Because of delays, about three months elapsed before bond wires were installed in this territory, and, somewhat to the surprise of the signal forces, no track-circuit failures occurred during this period. These circumstances seemed to point to the conclusion that bonding is not essential to the successful operation of track circuits, at least so far as new rail is concerned. As a further test of this theory it was decided to defer for a time the bonding of 2½ miles of new 90-lb. rail that was laid in the following year near Kiowa, Okla. As the track circuits in this territory continued to operate satisfactorily for several months, the chief engineer authorized the signal department to discontinue the application of bonds on new rail. Since that time, new rail has been laid on 125 track miles on which track circuits are being operated without bonds.

This railroad has found that an electrical resistance sufficiently low to carry the track circuit may be maintained in the joints without bonds by simply keeping the bolts in the joint sufficiently tight. Aside from its influence on the maintenance of the track circuit, this policy has, in the opinion of maintenance of way officers, resulted in an improved track condition and, by reducing the amount of rail batter, has materially extended the useful life of the rail.

Almost all of the new rail laid in Katy tracks during the last few years is of 90-lb. R A section, with 24-in. angle bars having four holes on 5½-in. centers. The bolts are of heat-treated steel and are equipped with spring washers. As the joints are being applied, a coat of oil is spread on the fishing surfaces and the bolts are tightened in the usual manner. After the rail has been in service a few days, any bolts that may have become loose are retightened, and thereafter the track foreman follows his usual routine of inspection to keep the joints tight. Once each week, the signal maintainer takes a reading of the voltage at each end of every track circuit

View of a Typical Joint in Non-Bonded Territory on the Katy

and records these readings in a note book. If any changes are observed in the rail resistance, which may be caused by rust or loose bolts in rail joints, he locates and marks the joint and notifies the track foreman.

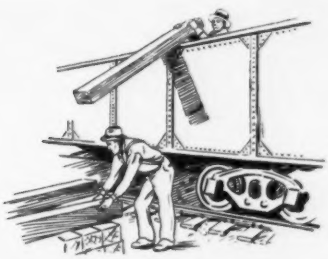
Once during the year, ordinarily in the spring, each joint is oiled by a pressure pump having a nozzle that sprays oil behind the bar. A fairly good grade of lubricating oil, thinned with kerosene, is used for this purpose. This oil penetrates to the fishing surfaces between the angle bars and the rail, where it tends to reduce the wear, thereby preserving the fit of the fishing surfaces and lengthening the life of the joint. A secondary effect of the use of the oil is the prevention of rust and the maintenance of a clean contact between the fishing surfaces. This results in a low-resistance electrical contact for the track circuits.

From the standpoint of safety, officers of the Katy feel that a joint without a bond is safer than one with long bonds extending beyond the angle bars. This is because the breaking of the angle bars in a joint not equipped with bonds is almost certain to interrupt the signal circuit, which would be quite unlikely if the joint was equipped with bond wires. The same result is produced in the event of a break in the rail between the end of the joint and the point where the holes for pin-type bonds are ordinarily drilled.

Some of the non-bonded track circuits have been in satisfactory service on the Katy for more than six years, although there is some question as to whether it will be possible to keep the joints tight enough throughout the entire life of the rail. However, even if it becomes necessary to bond the rail after 10 years' service, it is felt that one of the cheaper methods of bonding will then be satisfactory. While the expense of maintaining the bonding for the 10-year period will have been avoided.

Records show that the Katy has fewer track-circuit failures per mile on non-bonded track than on track which is bonded.

Rails and Ties



Can They Be Handled Safely?

By JOHN W. SIMS
Supervisor, Illinois Central, Dubuque, Iowa

IN order to handle rail safely, attention should first be given to the proper placing of the rails in the car, as there is serious danger of injury to the hands and feet of the men doing the unloading if the rail is improperly loaded. Frequently, when cars are loaded in a haphazard manner with a magnet or crane, it is almost impossible to unload the rail without serious difficulty. To avoid this danger, the rail should be loaded by placing the first tier work-way along the bottom of the car. The second layer is then rolled in across the first tier with the balls turned downward, the tiers being alternated in this way throughout the loading of the car. With this method, a safe footing is provided for the men, whether they are loading or unloading the rail.

Organization for Proper Loading

The proper loading of rail requires a gang of six men and a crane operator, all of whom should be experienced in the handling of rail. A power crane, operated by either steam or gasoline should be used. When loading rail, three men are placed on the ground and three in the car, one man in each group handling the rail clamp and the other two steadying the rail. The center of each rail should be marked before the loading is commenced, so that the clamp man on the ground will know exactly where to place his clamp. After the clamp has been applied to the rail, the clamp man signals the crane operator to hoist the rail. As it is lifted, the two men on the ground steady it at either end until it reaches the level of the car, after which the two men on the car continue to steady the rail and also assist in guiding it to its proper position on the car. When the rail reaches its proper place, the clamp man on the car signals to the crane operator to drop the rail.

The directions for unloading rail are similar to those for loading. Again, three men are placed in the car and three on the ground, and are given the same positions as in the loading gang. When the clamp is properly placed in the center of the rail, the clamp man on the car signals the crane operator to raise the rail and swing it to the outside of the car. The two men on the car steady the rail while it is going through this movement. The rail is then lowered to within two feet of the ground, where the men on the ground guide the rail into position so that it is end to end with the adjacent rail. This can easily be done by forcing the rail ahead three or four feet, and allowing it to swing back against the adjacent rail and then dropping it into position. Rails should be handled carefully as careless handling often damages them.

Of equal importance with the placing and training of the men is the handling of the train. Train and enginemen should be cautioned to handle the train carefully and to see that no sudden or violent stops or starts are made. The abrupt starting and stopping of the train is very dangerous and hazardous to the men handling the rail on the car. It may throw them off their guard and cause them to be injured by the swinging rail. A uniform speed of from three to four miles an hour is correct for both the loading and unloading of rail, and the man in charge of the work should see that the train and engine crew fully understand this before the work is commenced.

This discussion comprises an abstract of a paper that was presented by Mr. Sims at a joint meeting of the Safety Section, American Railway Association, and the Railroad Section of the National Safety Council at the Twenty-Second Annual Safety Congress and Exposition at Chicago. It is divided into two principal parts, the first dealing with the safe handling of rail and the second with the safe handling of ties.

Safety in Laying Rail

Next in importance to the loading and unloading in the handling of rail is the proper method of laying it in the track. When removing old rails during warm weather and the joints in the old rail are tight, three spikes should be left on the inside of each of the rails that are to be removed. When taking out the rails, the man removing the three spikes should always stand on the outside of the opposite rail, in order to prevent the rail from striking his feet if it should buckle in or jump toward the other rail, as sometimes happens.

A power crane should always be used in placing the new rail and the gang should include three men besides the crane operator, one of whom acts as the clamp man.

The latter should give all the signals, and the crane operator must not take signals from anyone except him. The rail should never be raised higher than two feet from the ground, as this policy requires the men handling the rail to bend over, in which position their feet are protected in case the rail should drop accidentally. In moving the rail to its position on the ties, the man nearest the crane should handle the expansion shims. In getting rails into position for the clamp, either rail forks or rail tongs should be used and the rail should never be handled with the bare hands.

Usually when it becomes necessary for a small section gang to replace a defective rail, the problem arises of transferring a rail from a rail rest to a push car. In doing this the rail should first be dropped off the rest, after which, using rail tongs, it should be transferred to the center of the track, one end of the rail being carried at a time. The men should then lift one end of the rail sufficiently to permit the foreman to move the push car under this end of the rail. When the end of the rail has been placed on the car, two men are stationed on the car and two on the ground. As soon as one-fourth of the rail is on the push car, the other end is lifted by all the men and rolled on a pipe or rail dolley until it is balanced on the push car.

Unloading the Rail from a Push Car

In unloading the rail, it should be removed over the side of the car. It is a dangerous practice to pick up the rail and attempt to throw it clear of the pushcar, and it is also bad practice to roll the rail off the car without using skids. I know of cases where serious foot injuries were sustained when the rail was picked up and thrown from the car, owing to the loss of footing of the injured man or the bouncing of one end of the rail. Two bars should be placed under the rail at the ends of the push car to act as skids on which the rail slides to the ground, as this method protects the push car and breaks the fall of the rail. When handling rails in yards, the use of a push car with a small hand derrick is very satisfactory and has eliminated many personal injuries.

Almost as many injuries occur in the work incident to cutting rail as in the handling of it. Many eye injuries and serious cuts have been sustained by men engaged in such work. The introduction of acetylene torches materially reduced the number of injuries due to this cause, but it is still frequently necessary to cut rails with track chisels. When this is necessary, the greatest care should be exercised. Those men not directly engaged in the cutting should be stationed where they will not be struck by flying chips, or if it is necessary for them to work nearby, they should not face the place where the cutting is being done. The man holding the chisel should always wear goggles. The chisel itself should be provided with some sort of guard, consisting of either the regular hood or one made from a piece of old air hose. Frequent inspections should be made to see that chisels with battered heads are not kept in service.

It is of particular advantage to have available a small number of men trained in the handling of rail and always use them for this work, as this practice will eliminate many personal injuries. I have unloaded rail that had been improperly loaded and while the unloading was slow I feel that it could not have been done without personal injuries if the men had not been trained in the handling of rail.

As with rail, the safe handling of ties also starts with the loading of the ties. From a safety standpoint, crossties should be loaded in coal cars in a flat position and crosswise with the car. If loaded in stock cars or box cars, the ties invariably shift in transit and, as a consequence, there is an absence of secure footing for the men who are assigned to the unloading of the cars.

If ties are loaded crosswise in coal cars there is no opportunity for them to shift, the footing is secure, and it is not necessary to carry them lengthwise in the car for unloading. Two men are not sufficient from a safety standpoint to pick up a heavy creosoted tie and throw it out of a car. Three or four men, if necessary, can co-operate in lifting ties and sliding them over the side of a coal car, while in a box car two men always have to handle the tie. Unloading from coal cars requires special attention on the part of the foreman to make sure that there are no men in the danger zone on the ground along the cars as the men in the cars cannot see those on the ground.

In unloading ties from stock or box cars, the first consideration is safety. Not more than two men should be assigned to the work of removing the first ties, since there is not sufficient space to permit more to work safely. These men should remove a sufficient number of ties, probably about 100, to give a clear working space. It is then satisfactory to put in one or two additional men, but the number should never exceed four in cars of these types.

As soon as the space at the door of the car will permit, a tie should be placed crosswise in the door and used as a skid in unloading the ties, so that they can be thrown endwise out of the car. Unloading in this manner requires less effort, promotes safety, prevents the scarring or bruising of the ties from contact with the car and the ballast shoulder, and lessens the ground work materially.

Very few personal injuries occur in the piling of ties, but they are very likely to occur when the ties are being placed in the track. Tie tongs should be used in pulling the tie into place in the track, and the men should watch their footing and be certain that they can step back without tripping over the rail if the tie should slip suddenly or the tongs come loose. The tong man should be certain that the tongs have a good hold on the tie.

The track foreman is the man who is in charge of much of this work, and it is the duty of the superior officers to instruct the foreman fully in the safe methods of handling the work.

A Correction

THE article entitled "Applying Insulated Joints Requires Care," which appeared on page 330 of the June issue, was prepared as an answer to a question in the What's the Answer department. It was too long for use in this section of the magazine and yet too valuable to omit from publication, for which reason it was published in the feature section. To adapt it for this use, an introductory paragraph was prepared, which Mr. Schermerhorn advises was in error in the following respects: The insulating fibre, to which reference is made in the second sentence, is manufactured from a carefully selected quality of cotton rags, instead of wood fibre as stated. In the same sentence it is stated that the insulation is placed beween the rail and the bolts; this should have been between the joint bars and the bolts. Through a typographical error, Mr. Schermerhorn's name was published incorrectly; his correct name is E. F. Schermerhorn.

Central and Transit-Mixed Concrete—An Evaluation

[The central-mixing and transit-mixing methods of placing concrete have come into wide use in recent years because of a number of advantages which they possess as compared to the mixing of the concrete at the location where it is to be placed. It appears, however, that these methods also have certain disadvantages, according to a report that was presented by a subcommittee of the Committee on Masonry of the American Railway Engineering Association at its last convention. This report, which lists the advantages and disadvantages of the two methods, is abstracted below.—Editor.]

WITHIN the last few years large investments have been made in central plants for the storing of concrete materials and the batching, mixing and distribution of concrete to construction jobs over wide areas. At first there was well grounded objection to the output of such plants, owing to the compacting and segregation that occurred in concrete that was transported considerable distances in ordinary truck bodies. This objection was met by the development of "agitator" trucks and later of truck mixers which were equipped with devices for controlling the introduction of water, the time of mixing, etc.

Central mixing plants introduce various complications in the tasks of engineers, inspectors and contractors concerned with their product. Some of the advantages and disadvantages of this method of mixing concrete may be listed as follows:

Advantages.—The chief advantage of a central mixing plant on the manufacturing side is that a permanent location and comparatively large output justify the installation of adequate facilities for the proper storage and classification of aggregates, for accurate batching by weight, for regulation of the temperature and for control of the water-cement ratio. A good water supply is also available.

Most up-to-date plants employ agitator trucks to transport the mixed concrete from the central mixing plant to the job, which should insure the transportation of concrete over long distances without segregation of the materials and promote easy discharge of the concrete in good condition for use on the job.

The advantages to the purchaser include:

(a) Saving of storage and care of materials. This is a real advantage on many small railroad jobs where the space is limited, and often eliminates the necessity for a construction track at the job, thus contributing to economy.

(b) The concrete plant, including mixer and appurtenances, is dispensed with.

(c) Labor costs are reduced as it is no longer necessary to keep a concrete gang "standing by" waiting for concreting operations.

Disadvantages.—(a) Difficulty of providing for proper inspection of the concrete. On the smaller railroad jobs, it is expensive to furnish an inspector at the central plant in addition to the man at the job, although, otherwise, the operator at the central plant must be relied upon to proportion and manufacture the concrete according to instructions. Also, if poor concrete arrives on the job, it is impossible to correct the underlying conditions promptly as there may be several truck loads in transit.

(b) The possibility of truck failures or delays due to traffic, etc.

(c) Difficulties incident to the furnishing of special placing equipment, such as elevating machinery.

(d) If the purchaser furnishes his own bin-tested cement various difficulties are encountered in checking the shipments, and in obtaining segregation of the owner's cement for use in his work.

(e) Delays and irregularities in delivery, depending on the distance of the job from the central plant, may increase costs or cause confusion on the job.

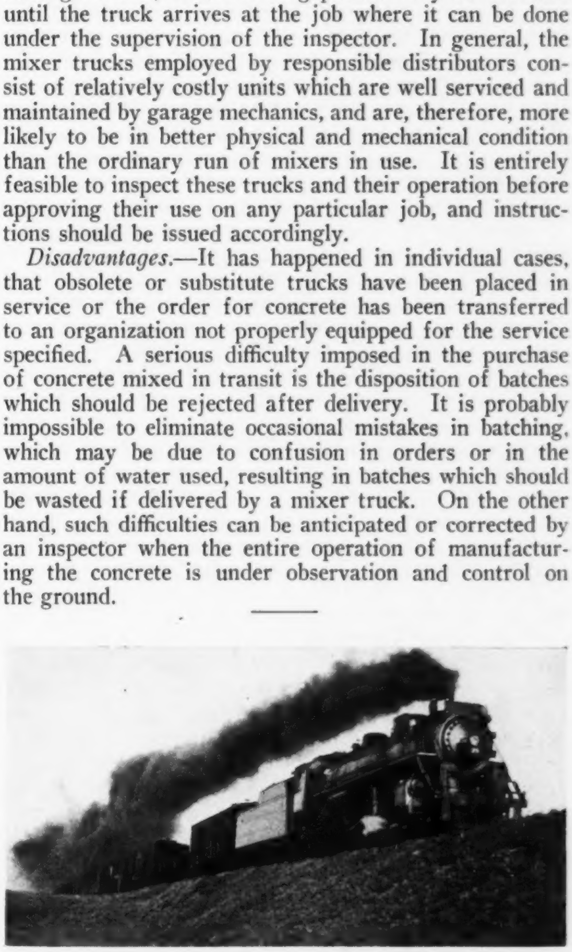
Transit-Mixed Concrete

Prior to the introduction of transit mixers, concrete mixers were fairly well standardized and the relationship of the capacity to the diameter of the drum and the peripheral speed had been established within certain limits. The design of mixer trucks, however, is not so standardized and the question is naturally raised as to the relative merits of each design. In general, it is recommended that transit mixers should be cylindrical in form, the diameter of the barrel being large in proportion to the length, and the mixing mechanism driven by an engine independent of the truck motor. Some manufacturers do not recommend truck mixers of over 3½ cu. yd. capacity.

The considerations listed as to the advantages and disadvantages of central-mixed concrete apply to a considerable extent to transit-mixed concrete and, in addition, the following should be noted:

Advantages.—The batched materials may be carried dry in the truck mixer until a predetermined point has been reached enroute, where the water is added and the mixing started; or the mixing process may be deferred until the truck arrives at the job where it can be done under the supervision of the inspector. In general, the mixer trucks employed by responsible distributors consist of relatively costly units which are well serviced and maintained by garage mechanics, and are, therefore, more likely to be in better physical and mechanical condition than the ordinary run of mixers in use. It is entirely feasible to inspect these trucks and their operation before approving their use on any particular job, and instructions should be issued accordingly.

Disadvantages.—It has happened in individual cases, that obsolete or substitute trucks have been placed in service or the order for concrete has been transferred to an organization not properly equipped for the service specified. A serious difficulty imposed in the purchase of concrete mixed in transit is the disposition of batches which should be rejected after delivery. It is probably impossible to eliminate occasional mistakes in batching, which may be due to confusion in orders or in the amount of water used, resulting in batches which should be wasted if delivered by a mixer truck. On the other hand, such difficulties can be anticipated or corrected by an inspector when the entire operation of manufacturing the concrete is under observation and control on the ground.



A Freight Train of the Grand Trunk Western on the Detroit & Toledo Shore Line Near Pontiac, Mich.

What's the Answer?

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions that you may wish to have discussed.

Double-Shoulder Tie Plates

When renewing rail with the same section, where double-shoulder tie plates are in use, should one or both lines of spikes be pulled? Why? If only one line, how can the old rail be removed? How should the new rail be laid?

Only One Line Need Be Pulled

By J. F. DONOVAN

Division Engineer, Lehigh Valley, Wilkes-Barre, Pa.

It is necessary to remove only one line of spikes. In fact, there is nothing to be gained by pulling both lines, except at points where the joints in the new rail fall. It is a simple matter which presents no difficulty, to place the base of the new rail under the line of unpulled spikes.

We find it preferable, generally, to pull the outside line of spikes, because this facilitates the handling of the rail, which we place just beyond the ends of the ties. In the event, however, that the renewal is being made across a long bridge or through a tunnel, where there is insufficient room to handle the released rail in this manner or to load it later, we pull the inside row of spikes on one line of rails and the outside row on the other. This enables us to place both lines of rails between tracks or on either side of the track as may be desired.

On the Lehigh Valley, on which road practically all rail is laid in long stretches by means of locomotive cranes, a special hook, which was described in *Railway Engineering and Maintenance* for January, 1933, is used to tilt the rails enough to permit them to clear the shoulder of the tie plate on the side from which the spikes have been removed. Then, after the rail has been raised high enough, it is swung horizontally by the crane to place it in its final position clear of the ties.

This hook is a simple tool, consisting essentially of a bar of iron 17¼ in. long, so designed that it will grasp the base of the rail on the side from which the spikes have not been removed. The bar passes under the rail and the other, or lifting, end is attached to a lifting line from the crane. As this end is lifted, the rail is given enough of a rolling motion to bring it clear of the spikes and tie-plate shoulder. This hook can be used successfully, however, only where the old rail is not uncoupled before it is thrown out, for the part of the string not disturbed by the pull prevents the rail to which the hook is attached from rotating more than is necessary to clear the shoulder, generally not more than 30 deg.

Where locomotive or other rail-laying cranes are not available, or where the stretch to be renewed is too short to warrant their use, as on short curves, the old rail can be removed by hand by means of lining bars. In this case, two men are required, one to raise the rail and the other to insert a spike at several points to hold it high enough to clear the shoulders of the tie plates, after which it is thrown out by the regular force usually organized for this purpose.

When the new rail is laid, it is merely shoved over with one or two lining bars until the base fits under the heads of the spikes (this usually presenting no difficulty) when it drops into place between the shoulders. On curves, there must be one man at each end of the rail to pinch it into place.

Would Always Pull Both Lines of Spikes

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

It has been my experience that when rail has been in service long enough to require renewal, both lines of spikes should be pulled, regardless of whether the tie plates have double or single shoulders. The reason for this is that if traffic is of sufficient density to require the use of tie plates, all, or most, of them will have cut into the ties, and a large percentage of those that have will be out of level, while scarcely any two plates on individual ties will be in the same plane. It follows, therefore, that the plates should be removed and the ties adzed, not only to level up the bearing for the plates, but to bring both of the plates on an individual tie into the same plane; otherwise, the life of the rail will be affected adversely, while it is likely that unknown strains will be set up in the flanges as a result of the uneven bearing.

Again, where double-shoulder tie plates are in use, it

To Be Answered in September

1. *Is the selective or the out-of-face method preferable for building up rail joints by welding? What considerations determine this?*
2. *Is the use of metal sheets over the ties of open-deck bridges an effective method of fireproofing? What are its limitations?*
3. *When laying rail, should the fishing surfaces be oiled before or after the rail is set in the track? Why?*
4. *What are the relative advantages of wood, copper, tin and galvanized gutters? Should they be painted? Why? If so, what kind of paint is most suitable for each?*
5. *When applying ballast or surfacing new rail, how many jacks are required? Why? How should they be placed? How close to the jacks should the tamping progress before they are moved forward?*
6. *What are the relative advantages and disadvantages of electric motors and Diesel engines for pumping water for railway use?*
7. *In what ways are shovels used improperly? What measures can be taken to correct these practices? How should they be used?*
8. *Where a solid bridge floor of steel-plate construction is subject to brine drippings, what methods can be employed to protect it from corrosion?*

is a difficult and somewhat laborious task to line out the old rail if one line of spikes is allowed to remain, unless they are eased off slightly. In this event, however, it is better to remove the spikes and plug the holes, since, if they are merely tapped down, the hold on the tie will have been broken. Every experienced track-man knows that this is not the proper way to obtain a good job of spiking.

How shall the new rail be laid? The only way to handle a job of renewing rail, if best results in rail life and track conditions are desired, is to pull both lines of spikes, remove the tie plates, plug the holes and adze the ties, so that the new rail will have an even bearing at all points. But since we have been striving for production in all phases of maintenance, some may raise the criticism that all of these operations slow down production, that with heavy rail and large tie plates there is little cutting into the ties and that such refinements are not necessary.

My only reply to this criticism is that there is only one way to get a good job, and this is by giving the same careful attention to the details that is given to the general features of the work. In laying rail, as in many other operations, it is the details that differentiate between first-class work and poor work. There is economy in first-class work, but waste in poor work.

Ease Outside Spikes About One Inch

By L. A. RAPE

Section Foreman, Baltimore & Ohio, Renfrew, Pa.

When renewing rail where double-shoulder tie plates are in use, I have not found it necessary to pull both lines of spikes. I find it preferable to pull the inside line of spikes only, except as it sometimes becomes necessary to pull all spikes at joints, and to ease the spikes in the outside line about one inch. Then, if the rail is to be thrown out in a string, two men with lining bars, followed closely by one man with a pinch bar to raise the base of the rail above the shoulder of the plates, can line out the old rail, throwing it across the opposite rail, which helps to raise it out of the pocket between the shoulders. The new rail can then be laid in place with the same ease as if the tie plates had a single shoulder.

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Replacing Slate

What methods should be employed to replace loose or broken slate in a slate roof?

This Operation Requires Skill

By Supervisor of Bridges and Buildings

Slate roofs are not as common in the Middle West as they once were, for which reason the number of men on a division who are skilled in their maintenance is much smaller than formerly. The replacement of broken or loose slate, while a relatively simple matter, is a job requiring skill, and should never be assigned to inexperienced men or foremen.

To remove the remnants of the broken slate a ripper is used. This is a thin-bladed tool having a hook at the end, with a sharp edge on the inside of the hook. It is inserted under the overlying slate and around the nails holding the broken unit, to cut them off. The new slate is then slipped into place and, if practicable to do so, the overlying slate is raised slightly. A copper slating nail is then driven as far under the edge of this slate as can be done without chipping it. If this is impracticable, a copper strip from 1½ to 2 in. wide is shoved far enough under the new slate to extend beyond the exposure of the course, leaving a free end about one inch long. The nail is then driven through it immediately below the edge of the next higher course. The location of the nail should be chosen so that it will not penetrate the slate in the next course below. The free end of the copper strip is then bent back over the new slate. Finally, the nail head is plastered with a well-troweled plastic cement.

Can Employ Either of Two Different Methods

By A. T. HAWK

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

There are really two different methods, either of which can be employed in renewing an individual slate that has become loose or broken in the body of a slate roof. In the first place, it is highly essential that men who are accustomed to working on slate roofs be employed for this purpose. Otherwise, inexperienced workmen are likely to do more damage than good, since walking on a roof of this type must be done with care.

It is the almost universal practice to apply slate roofing in one way, that is, with a 3-in. lap under the second succeeding slate that is laid. If the slate to be used is 12 in. by 20 in. in area, subtracting 3 in. from 20 in. leaves 17 in., and dividing this by 2 gives an exposure of 8½ in. for each course of slate. Nailing is usually done near the top of the slate shingle. This method is called head nailing and is, or always should be, done with copper nails, this being the only type that will last for a long time.

It is obvious that where this method of application is used, the problem of taking out a broken slate is to remove or cut off the two nails that are hidden under the slate bed. For this purpose, a hooked hand tool known as a ripper is used. This tool has a thin blade with the cutting edge on the hook side of the blade, this being the side next to the handle. To cut a nail, the thin blade of the ripper is shoved under the broken slate and the two nails holding the shingle are cut off to allow the withdrawal of the anchored piece. After this is done, a new slate of the same size can easily be slid into the place of the old one.

It then becomes necessary to nail or fasten securely this new slate in some other way. For doing this, two methods are commonly employed. One of these, which is perhaps the better, is to use a strip of 18-oz. cold-rolled copper 1½ in. wide and about 3 in. longer than the width of the exposed slate. This copper strip is shoved up under the center of the new slate, leaving the bottom end of the strip about 1 in. longer than the exposed surface of the new slate. It is then bent up and back over the bottom edge. This is done immediately after the new slate has been secured, by driving a regular copper slating nail through the center of the width of the slate, as close to the edge of the one next above as is practicable. This nail will, of course, also penetrate the upper part of the copper strip as well as the new slate, which is prevented from moving laterally by the adjoining slate.

Another method in common use is to remove the old slate and shove the new slate into place as before, then pry up slightly the shingles that overlap the new slate and apply one copper slating nail directly in line with the overlapping old slate. Men accustomed to using this method become sufficiently skilled to be able to place this nail so that its head is partially covered by the old slate. Then some fibrous plastic cement of known quality should be shoved up under the overlapping slate and over the head of the nail to insure an absolutely weather-tight joint. It is also desirable to use plastic cement with the

first method, placing it around the head of the nail. It is important in both methods to drive the nails in the cracks between the two adjacent underlying slates. In the better class of work care must be exercised to see that the plastic cement is applied in a neat and workmanlike manner; otherwise, the splotch of cement will detract from the appearance of the roofing.

Where a slate is loose but not broken, the procedure to be followed is the same as already described, except that the old slate may be re-used if it is still serviceable.

For many years it was a common practice to apply slate roofing to roofs having large areas, such as shops, stations, freight houses and other large buildings, provided the roof had sufficient pitch. This type of roof lasts longer than any other, except possibly the better grades of burned tile roofing. It is not unusual for a slate roof to last for 50 to 60 years, and there are many still in service that are still older. The life of this type of roof has been determined, however, in many instances, by the life of the nails used in applying it. For this reason, it is highly important that only copper nails be used for this purpose.

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Mowing the Right of Way

Should the right of way be mowed more than once in a season? Why? If so, when should each mowing be done? Should it be burned after each cutting? Why?

Weeds Should Be Burned As Soon As Dry

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Poplar Bluff, Mo.

Most southern roads, especially those that are forced to contend with Johnson grass, find it necessary to mow a swath 6 to 10 ft. wide just outside of the track at least twice a year, and sometimes oftener. In general, if two mowings are required, the first one is started about May 15 and completed by June 1. The second is then completed between July 15 and August 1. Weeds and Johnson grass should be kept down, among other reasons, to insure safety in the operation of motor cars. In stock country where stock may break in, safety is conserved by maintaining a clean right of way. If vegetation is kept cut, the wind and sun will have a better chance to keep the roadbed dry and better-riding track will result.

Conditions will be much better if grass and weeds are burned after each cutting as soon as they have dried out enough to burn freely. Burning will check the growth of other vegetation and will kill many of the seeds that might otherwise germinate.

Depends Largely on Local Conditions

By G. M. O'ROURKE

District Engineer, Illinois Central, Chicago

We find it necessary to cut a swath along the shoulder of the roadbed and to mow the station grounds and around highway crossings, during the last half of June, to provide a clear view of all right-of-way signs. Beginning about August 15 of each year and continuing until completion, we mow all of the right of way on our northern lines where the local maintenance of way officers decide that it is necessary to do so. We then follow this up with burning as soon as the cut vegetation is dry.

Where there are few weeds and the grass does not grow very high, the weeds may be left standing until they are killed by frost, after which they are burned. When this can be done, the cost of mowing is saved. On unimportant branch lines it is not necessary to mow the right of way annually. Instead, the vegetation can be allowed to grow until it becomes heavy enough to interfere with the telegraph wires or the view of trainmen. When this point is reached, it should be chopped down, piled and burned.

In every case, cut vegetation should be burned as soon as it is dry, to prevent fires, which may be set out by sparks, from spreading to adjacent land.

In deciding whether the right of way shall be mowed more than once in a season, or whether it shall be mowed at all, consideration must be given to the importance of the line, the character of the country through which it passes and whether the road can afford to spend the money required to do so. Whatever the decision may be, however, the ground under and around wooden bridges should be kept free of grass and weeds.

Would Burn After Each Mowing

By HENRY BECKER

Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

There is only one reason why the right of way should be mowed more than once in a season, this being where the different varieties of weeds that have obtained a foothold mature their seeds at different times. In this case much seeding of the ground by noxious weeds can be avoided by two cuttings. The time can be selected so that the mowing will be done just before the most troublesome weeds go to seed, in which event these varieties will be largely eliminated.

It is a good thing to burn the dead material as soon as it is dry enough. With the most careful selection of the time there will be some plants that have matured their seeds and if the burning is done before these seeds have shelled out, there will be no chance for reseeding. Furthermore, and this is of considerable importance, the right of way will be clean and it will not be necessary to contend with a mat of dead dry grass and weed stalks.

Mowing Improves Appearance

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

It is not necessary to mow the right of way completely more than once a year. This statement is based on my own experience, although in other sections of the country with which I am not familiar more than one cutting may be required. A partial mowing, however, covering a strip out to and slightly beyond the shoulder of the roadbed will add greatly to the appearance of the right of way until the time arrives for the general mowing. This applies particularly to sections where a sod line is maintained. It cannot be escaped that while mowing improves the appearance of the right of way, it does not improve the riding qualities of the track. For this reason, in these days when the sections are so short handed, no more time than is absolutely necessary can be spent on this form of policing.

Since the conditions on every section differ in some respects from others, no specific day can be said to be the best time to start mowing. In my experience, I have found that the best time to begin is just before such noxious weeds as may be present go to seed, that is, the mowing should be completed before these seeds have reached the stage where they will germinate.

There are two excellent reasons why burning should be required to be done as soon as the cut vegetation is dry enough. First, this will prevent grass fires that may

get out of bounds and spread to adjacent property, where they may do much damage unless they are properly controlled. Second, burning at this time will kill any seeds that may have matured and thus retard the spread of noxious weeds in later seasons.

Should Be Mowed Twice a Year

By L. A. RAPE
Section Foreman, Baltimore & Ohio, Renfrew, Pa.

Right of way should be mowed twice in a season to kill as many varieties of weeds as possible before the seeds ripen. In our climate this should be done in June and again in September. There is some debate as to the desirability of burning after each mowing. The ideal condition is to have the entire right of way sodded. Mowing tends to encourage the growth of grasses by eliminating perennial weeds, since this gives the grass an opportunity to spread. On the other hand, too much burning over an area damages the grass and finally reduces the ground to a condition where nothing but the hardiest weeds will grow on it. While, from the standpoint of fire hazard it is desirable to do the burning after each mowing, this consideration and the fact that it sometimes promotes erosion, especially in hilly country, makes it necessary to eliminate all but one burning a year.

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Renewing Ties

In view of the reduced maintenance of the last four years, should ties be dug in or should the track be given a light raise in connection with tie renewals? Why?

By All Means Raise the Track

By G. A. PHILLIPS
Chief Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Unless one is greatly restricted by financial considerations, when performing work on heavy-traffic main tracks, I would by all means raise the track enough to insert the ties. This avoids destroying the old bed and improves the riding quality of the track, besides being the most economical method of handling the work. On light-traffic lines ballasted with locomotive cinders or other material easy to handle, it may be economical to dig in the ties, especially when the renewals are light.

Depends on Size of Force Available

By HENRY BECKER
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

Based on experience, I am convinced that best results can be obtained, especially at present and in view of the reduced maintenance for several years, by giving the track a light raise as the ties are being renewed. We are facing a situation, however, where this is scarcely possible, so that at present I think it is good judgment to dig in the ties. With the amount of deferred maintenance that has accumulated and the force we have available, we are hardly in shape to apply the time and effort required to give even a light raise to any considerable amount of track. Our tie renewals continue to be light and I think it better to dig in the ties and spend the time that is left in smoothing the track to keep it riding as well as possible. I hope the day will shortly arrive, however, when we will be in position to do our work in accordance with best practice.

Track Gets Kinky If Not Raised Occasionally

By J. MORGAN
Supervisor, Central of Georgia, Leeds, Ala.

If the track has been allowed to run for four or five years without having been given a general surfacing, I believe that it should be given a light raise in connection with tie renewals. Otherwise, the riding conditions become unsatisfactory, the rail looks kinky and drainage is more or less retarded by the ballast which has become compacted under the ties. Where ties have been dug in for four or five years, the track is almost certain to become center bound, and will not look or ride as well as track that is raised out of face at intervals of four or five years. Furthermore, drainage is very materially improved by regular surfacing of this type.

Track Should Be Raised at Intervals

By J. A. GIVEN
District Engineer, Southern Pacific, Dunsmuir, Cal.

Any answer to this problem revolves largely around the number of ties to be renewed and the general condition of the track. If the ties to be renewed over a short stretch of track are more than four to the rail, it is economical to make a light raise. Where the track is in good line and surface, however, and does not require a raise, it is not economical to do this and the ties should be dug in. In general, any section of track will require a raise out of face after a period of years. This period will depend on a number of factors, including the kind of ballast, the character and density of the traffic and weather conditions, but obviously, such a raise will be made by extra gangs rather than by section gangs.

A Light Raise Will Improve Riding Quality

By W. H. SPARKS
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Tie conditions are good today on most roads as a result of the use of preservative treatment over a period of years, although during the last four years renewals have fallen far behind the average for the decade preceding the slump in business, which began in 1930. On the other hand, the sharp reductions in maintenance forces that have been necessary, have made it impossible to do general surfacing in connection with the tie renewals that have meen made. The result is that our tracks are not riding as smoothly as they should.

Every experienced maintenance officer knows that when track has been carried for about so long, this period depending on many local factors, without having a light raise, it rides "dead." Many miles of track are now in this condition, which is somewhat aggravated by the fact that for several years practically all ties used in replacement have been dug in. This is a matter, however, that cannot be corrected so long as the present restrictions on maintenance forces remain.

Where tie renewals are heavy, it is scarcely debatable that the track should be given a light raise. On the other hand, there are many miles of track that still require relatively light renewals. Ignoring heavy renewals for the moment and taking the foregoing factors into consideration, we must face the situation as it is. It is my belief, therefore, that the best solution of the problem until we can increase our forces materially, is to complete the program of tie renewals by the digging in method, and then send the men we have available over the track to put it in the best condition we can with respect to line and surface. Points can be selected

where the track is becoming center bound or is badly in need of a light raise because it is "dead," and a light running surface can be given that will result in a marked improvement in the riding qualities. Even with our light forces, by good management on the part of supervisory officers and foremen, a certain amount of this work can be done every year, although it will fall short of what is really needed.

From the standpoint of best practice, there is only one satisfactory system of track maintenance, and that is to give the track a light raise at about regular intervals. At present we should do as much of this as our means will permit. Otherwise, our rails will become line and surface bent and other ills will follow.

Number of Ties to a Rail Makes a Difference

By L. A. RAPE
Section Foreman, Baltimore & Ohio, Renfrew, Pa.

In line with the practices the railways have been compelled to adopt for several years, tie renewals are still being skimped, as compared with the years prior to 1930. Where renewals are heavy, a light raise might be desirable, but where they go in at the rate of one to a rail length or more, digging them in will save much time. There is no doubt that in many places the track needs a light raise, but there are places where this has been done without replacing the ballast that was used up in the operation. It is better to dig in the ties in such places, and here a relatively short time is required.

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Which Edge Up?

Should the heartwood of a treated bridge stringer be placed up or down? Why?

Depends on Number and Location of Knots

By L. G. BYRD
Bridge and Building Supervisor, Missouri Pacific, Poplar Bluff, Mo.

It is our custom, for both open and ballast-deck trestles, to frame and bore all stringers before they are treated. Our instructions to the foreman at the framing plant are that he shall make a close inspection of all of the untreated material to detect knots in the narrow face of the stringer, which might cause it to break under load. If such knots are present, the stringer is to be so framed that they will be in the top face, which will be in compression under load. Otherwise, it is our practice to do the framing so that the heartwood will be down when the timber is in position.

There is an important reason for doing this. Heartwood resists crushing stresses better than the sapwood, so that stringers installed with the heartwood down are much less likely to fail from crushing at the bearing over the caps than if the bearing is on the sapwood. Many stringers have been replaced long before their service life had been exhausted otherwise, merely because the bearing was on the sapwood. Where one or two stringers in a chord have the heartwood down and the remainder have the sapwood down, there is an uneven bearing and the trestle rides "rough," especially if it is open deck construction. In addition, more load is thrown on the other stringers and the stresses in them are thereby increased.

I had occasion recently to turn several stringers that had been applied several years ago in an open-deck trestle. These timbers had been applied with the heartwood up and were beginning to show incipient crushing over the cap, while those having the heartwood down were not.

Heartwood, especially in long-leaf yellow pine, which we use largely in our bridges, resists the penetration of the preservative to a much greater extent than the sapwood. We have found that where the heartwood is placed up, and the stringers are not protected by deck planking or fire shields, they tend to bleed severely during hot summer weather. They also check rather badly, which allows water to reach the untreated zone and start decay. We do not experience either of these troubles where the heartwood is turned down.

Position Should Not Affect Durability

By H. AUSTILL
Bridge Engineer, Mobile & Ohio, St. Louis, Mo.

In general, the position of the heartwood in a treated stringer should not greatly affect the durability of the treated timber. I prefer, however, to place the heartwood edge down, because this is its natural position. In this position there will be less chance for, and accumulation of, water entering the timber through shakes and checks. This practice also accords with the general practice followed in the placing of crossties. Furthermore, the sapwood is generally better treated and since the top of the stringer is more exposed to the elements, it is better to have this edge up.

In a stringer containing the pith checks, it is most likely to have one or more large checks running from the edge nearest the pith to the pith, and smaller checks running from the edge farthest from the pith—the sap edge —to the pith. In this event, it is obvious that it is desirable to have the heart edge down. If any wane is permitted by the specifications, it is most likely that this will occur on the corner of the sap edge, and had best be placed upward to insure a full bearing on the cap.

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Preparation for Lining

What preparatory work should precede the lining of track? Why? Which items are essential and which non-essential?

Track Out of Surface Cannot Be Lined

By L. L. ADAMS
Division Engineer, Louisville & Nashville, Evansville, Ind.

Before lining track, it should be surfaced, gaged and spiked. If it is not full-ballasted, it should be filled either before or as soon as possible after lining. Track that is out of surface cannot be lined properly, for which reason it is essential that the surfacing or smoothing precede lining. It is not essential, however, that the gaging be done before the lining, since this can be done afterwards. It should be done as promptly as possible, however, because if the track is out of gage, it will soon be out of line.

Lining Should Be Last Operation

By H. E. HERRINGTON
Section Foreman, Minneapolis & St. Louis, Jordan, Minn.

Line is a most important factor in the maintenance of good-riding track, but is so closely inter-related to surface and gage that it is impossible to disassociate any one from the others and still obtain satisfactory results. Experience has shown, however, that there is a definite or-

der in which these three items should be cared for in repairing track. Lining should be the last track operation performed, except that of dressing the ballast.

When repairing track, ties should be renewed, those out of position should be straightened and spaced, the track should be gaged and surfaced, all spikes should be tapped down, bolts should be tightened and anti-creepers should be reset. If the track has been surfaced out of face, the cribs should be filled with ballast to hold it in place after it has been lined, since stripped track cannot be brought to good line, particularly if the rail is tight. The track is then ready for lining. The best results can be obtained only where all of these items have been properly taken care of before the lining is started, and all of this work is, therefore, essential.

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Open Joints in Pipe Culverts

Where a pipe culvert pulls apart so that one or more joints are opened, what measures can be taken to correct the trouble?

Must Be Determined by Facts and Common Sense

By M. H. DOUGHTY

Engineer Maintenance of Way, Delaware, Lackawanna & Western, Hoboken, N. J.

I know of no general rule that will apply to the conditions laid down in the question. The method to be used in any case must be determined by the application of common sense and engineering experience to the particular set of facts that may be encountered. Where the pipe in question penetrates a railway embankment, the situation described in the question may possess serious potentialities and as a rule, for reasons of safety, will demand thorough-going treatment. Obviously, the seriousness of the situation will depend on the size of the pipe, the height of the embankment, the material with which it was constructed, the size of the drainage area served by the opening, the present magnitude and probable future extension of the failure, the nature of the subsoil, including the depth of yielding material, the grade upon which the pipe is laid and the nature and density of the traffic passing over the culvert.

Often, the first indication of trouble of this character comes to the attention of the track forces through the discovery of a hole in the roadbed, either under or alongside the track. When this happens, immediate measures should be taken for temporary support for the track, or trains should be detoured until the extent of the damage can be ascertained. As soon as conditions have been made safe temporarily, those in responsible charge should make a thorough and careful study of the situation, particularly of the character of the subsoil and the amount of stream flow during high water. If this study develops that the trouble is of a minor character and that little or no further subsidence is to be expected, then it may be that minor repairs, such as straightening up the dislocated sections of pipe and carefully filling all openings with concrete or gunite, will suffice.

In places where there is a possibility of a large flow of water, head-walls should be constructed and the footings should be carried down to solid material, or supported on piles or on a timber grillage. In some cases it may be found desirable to install a new line of pipe, jacking it through the embankment alongside the failed culvert or, in some instances, relocating it some distance away. After this is done, the old pipe should be filled, using rock for this purpose, except at the upper end which should be plugged with impervious material. Normally, all pipes carrying considerable water should be provided at the lower end with a suitable apron composed of paving stones, riprap or concrete.

Special problems of this type occur in peat bogs of considerable depth and in other places where there is a great depth of spongy, yielding or unstable material, or material that is unstable when wet. In these situations both the construction and maintenance of pipe and other culverts calls for engineering skill of the highest type. Years of experience with structures that must be built under such conditions tend, I think, to reduce rather than increase the assurance of an engineer who is required to handle work of this kind. Certainly, the subject is too broad and has too many ramifications to be discussed adequately in a single paragraph.

Hold the Pipe with Hook Bars

By C. S. HERITAGE

Bridge Engineer, Kansas City Southern, Kansas City, Mo.

This is a condition which has not troubled us to any large extent, but where the trouble has occurred we have usually been able to correct the condition satisfactorily by filling the openings between the separated sections with concrete or cement mortar, depending on the width of the gap. We had one experience with a cast iron pipe located on a hillside fill, in which the joints began to pull apart. In this case, to prevent further movement, we ran three heavy steel bars through the fill and hooked them over the ends of the pipe. This was not entirely successful, for a few years later the hooks on the rods broke, allowing the pipe to pull farther apart. Not only did the sections separate but they became out of line to such an extent that we finally replaced the structure in another location where the underlying material was firm.

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Filtering Water

Under what conditions should water for locomotive boilers be filtered? When is it not justified? What are the advantages?

Present Tendency Is to Eliminate Filters

By J. H. DAVIDSON

Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

In the early days of softening water for railway use, before fundamental principles of good design had been established, considerable difficulty was experienced in not a few instances with the continuous type of lime and soda ash water softeners, in preventing precipitates from carrying over from the settling tank. An attempt to prevent this carry over of the precipitates was made by installing filters of excelsior in many of these softeners. This usually consisted of a bed of excelsior from 18 to 24 in. thick, suitably supported by angle irons and perforated plates. It was placed near the top of the settling tank so that all of the water flowing upward in the tank passed through the filter just before leaving the tank.

Obviously, a filter of this kind could catch only the coarser particles, which would have settled out in any event, provided the plant had been properly designed. The result was that it became clogged rather quickly and required frequent cleaning or renewal. For this reason, filters of this type were discarded in large numbers. Modern plants are practically never designed to include

this type of filter. There are, however, a few of the older types of plants remaining, which are still equipped with these filters which, when they are properly maintained, justify the cost of keeping them in operation.

A few roads have installed sand filters, of either the gravity or pressure type, in connection with lime and soda ash water-softening equipment, to insure a perfectly clear treated water for boiler use. While some slight softening effect has been noticed as a result of their operation, this cannot be expected generally. Apparently the "after precipitation" that occurs in pipe lines can be decreased somewhat by passing the treated water through sand filters, since the precipitation takes place on the grains of sand. This causes the sand grains to "grow," however, and decreases the effectiveness of the filter bed, and increases the cost of maintenance.

If a treating plant is properly designed to insure the correct proportioning of the chemicals; if provision has been made for adequate mixing and settling time; and if a suitable rate of upflow has been provided for, it is possible, with the aid of special chemical coagulants, to soften, and at the same time clarify, practically all types of water, without the use of filters. For this reason, as well as because an installation of filters adds materially to the cost of construction, operation and maintenance of a water-softening plant, the present tendency is to design these plants in such a way as to make the operation of filters unnecessary.

While, as a general statement, this is true, it must be recognized that there are certain types of waters which can be clarified more economically by the use of filters than by sedimentation and clarification alone. Since it is important to provide locomotives with clear as well as soft water, filters should be used where waters of this kind are encountered. Filters are also valuable aids to plants that have been improperly designed and to plants which must be operated at capacities greater than those for which they were designed originally.

Many Local Conditions Affect This Problem

By E. M. GRIME
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

It is scarcely more than 30 years ago that most railways paid little attention to the quality of the water that was being provided for locomotive use. If the supply was dependable, that was about all that was asked for, or, as it has been stated, "anything that was wet enough seemed to answer the purpose."

In the early days of railroading, the burning of a crown sheet by reason of a heavy accumulation of mud and precipitated solids was not unusual. But about three decades ago, as traffic began to increase by leaps and bounds and locomotives were growing in size and power, the frequency of this trouble in certain districts finally brought the realization that it would be necessary either to secure a new supply of reasonably clear water or to clarify the existing supply by settlement or filtration, a practice that was then becoming common for drinking-water supplies.

When this was done, it was found in many instances that the removal of the mud and silt from the water, usually by simple sedimentation, only partially corrected the trouble, since an impervious white scale was deposited gradually on the boiler surfaces. It was thus developed that conditions requiring filtration of the water delivered to locomotives were also accompanied, in many instances, by conditions which necessitated treatment for the removal of scale-forming ingredients.

Under modern locomotive operating conditions, it is desirable that the water provided for them be practically clear or that it have a turbidity of not more than 15 or 20 on the Jackson turbidimeter indicator. Clarity of this kind can often be secured by a lime-soda ash water-softening plant. In many cases, however, it becomes desirable to augment such treatment by the addition of a small amount of sodium aluminate, which is particularly effective for removing the smaller and lighter parts of the floc. These usually consist, principally, of magnesium salts which, under ordinary conditions, do not settle out readily, but must be encouraged to do so artificially.

Under certain conditions it may prove to be more economical to use mechanical filtration for the removal of the fine precipitate which cannot be settled out satisfactorily in the time interval that can be allowed. In some instances where this is done, the treated water is allowed to flow by gravity through a sand filter, but where floor space and large capacity are necessary considerations, some design of pressure filter becomes desirable for this final refinement of the treated water.

Usually there are so many local conditions affecting this problem that it is rather impracticable to make a general statement as to when a filter is not justified. Under treated-water conditions some of the advantages of filtration are as follows:

A reduction of from one to two grains of hardness, such as is often accomplished by filtration, may eliminate the foaming of the water in boilers.

There should be a reduction of the amount of incrustation in cold-water lines.

There should be a reduction in boiler scale through the use of more completely softened water.

There should be a saving in chemical reagents, as well as some reduction in the total amount of soluble salts remaining in the treated water.

A filter may be justified for raw water when the turbidity is sufficient to cause serious locomotive operating troubles by reason of the accumulation of mud or other debris on the boiler sheets and tubes.

Locomotive Water Should Be Clear

By C. R. KNOWLES
Superintendent Water Service, Illinois Central, Chicago

As an ideal, clear water should be delivered to locomotive boilers. It should, therefore, be filtered or otherwise clarified when it contains suspended matter in such quantity or of such a character that it will cause additional expense in the operation or maintenance of the locomotive. It is extremely difficult, however, to present figures that will show definitely the damage created by suspended matter in locomotive-boiler waters, since the importance of its removal depends so largely on its character and the amount present.

An accumulation of mud in a boiler may result in serious damage to the boiler by reason of mud burns. This necessitates more frequent washing of boilers when the mud is of such a character that it cannot be blown out readily. Furthermore, silt or mud is sometimes deposited and held on the tubes and sheets as a part of the scale. Probably the most important feature of the removal of suspended matter from locomotive boiler water is that connected with the danger of mud burns.

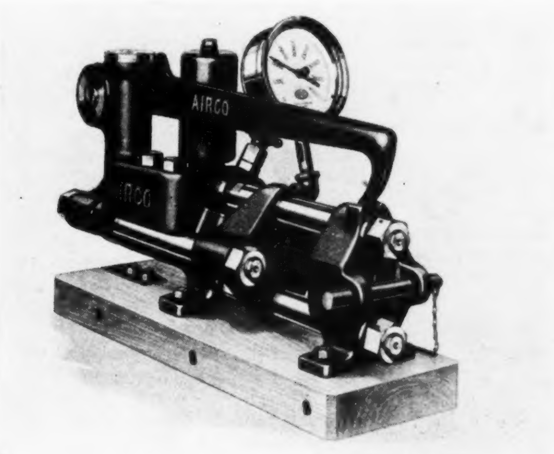
Rivers and other streams in the South and Middle West carry a heavy burden of suspended matter, averaging from 1 to 2 lb. per 1,000 gal. throughout the year, with the maximum of 10 lb. per 1,000 gal., while as much as 5 or 6 lb. is not unusual. It is apparent, therefore, that a locomotive may easily take into its boiler as much as 100 to 150 lb. of mud on a single trip, if facilities are not provided for the removal of the mud before the water enters the boiler. If this is not done or provision is not made for blowing it out of the boiler, serious damage will result to the boiler within a very short time.

New Device

Develops Portable Machine for Testing Welds

THE Air Reduction Sales Company, New York, has developed an instrument for testing the strength of welds, known as the Airco portable tensile and bend testing machine, which may be taken into the field for the testing of specimen welds. The machine, which is compact and comparatively light, consists essentially of an oil pump, a hydraulically-actuated piston or ram, two heads for gripping the test specimens, one fixed and one movable, and four symmetrically located steel shafts, two of which transmit the piston motion and load to the movable head while the other two maintain the alinement of the two heads, and prevent the introduction of bending stresses in the tensile test specimen.

By means of a long lever attached to the pump and the ratio between the areas of the pump plunger and the hydraulic ram, any downward force on the lever is magnified 400 times in the load applied to the test specimen. The load on the specimen is indicated on a six-inch pressure gage of special construction, which is mounted on the unit.



The Airco Portable Tensile and Bend Testing Machine

The size of the grips and the available distance between heads are such that tensile specimens 9½ in. to 10 in. long and up to ½ in. thick and 1½ in. wide may be tested. The maximum direct load that can be applied is 40,000 lb., but by using test specimens of small cross section, it is possible to develop stresses of 150,000 lb. per sq. in. or higher. The readings are said to be accurate to plus or minus two per cent. For making bend tests, the machine is provided with an anvil which fits into the movable head and which bends the specimen against a pair of supports set three inches apart and cast integrally with the body of the machine.

This machine is permanently mounted on a solid hardwood base which forms part of the packing case in which the unit is kept when not in use. The entire unit, including the case, has a total weight of slightly more than 200 lb.

What Our Readers Think

Transposing Rail on Curves

Evansville, Ind.

To the Editor:

I have been very much interested in the discussion by C. W. Baldridge relative to transposing rail on curves, which appeared on page 331 of the June issue of *Railway Engineering and Maintenance*. In the last two paragraphs of his article, Mr. Baldridge refers to the disadvantage of making the transposal by reason of the difference in length of the rails on the inner and outer sides of the curve. At a number of points on my division I have been able to eliminate this disadvantage by a very simple method. I lay no short rails on the inner side of the sharper curves, where I expect to transpose the rails at a future date. Instead, I make the adjustment on the tangent at each end of the curve and use the simple and familiar rule referred to by Mr. Baldridge in his discussion.

For example: Assume as a somewhat extreme case, a curve with 90 deg. central angle. This will mean that the inner rail is practically 90 in. shorter than the outer rail. Before starting to lay around the inside of the curve, the joint on the low rail is set back approximately 45 in. off center, then when the middle of the curve is reached, the joint at that point will be practically on center and when the far end of the curve is reached, the joints will be 45 in. off center in the other direction, and adjustments can be made at that end to bring the joints on center on the tangent beyond. In the ordinary run of curves encountered, this distance off center will be much less, usually not more than, say, two feet, which is nearly negligible where 39-ft. rails are used. This method also assists materially in transposing rails, as those on the outer side of the curve are all of the same length as those on the inner side. For this reason, the change can be made a rail at a time, without any complications and with no cutting of rails, provided proper expansion is maintained. Furthermore, trains can be let by very quickly at any time with practically no delay when this method is used.

In transposing rails, short rails on the inner side of the curve have always presented more or less difficulty, but I believe the practice described will eliminate this objection.

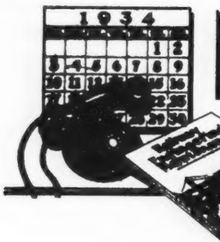
Thomas Walker,
Roadmaster, Louisville & Nashville.

New Book

Ives Tables, Second Edition

MATHEMATICAL TABLES, by Howard Chapin Ives, 160 pages, 7 in. by 4 in. Bound in imitation leather. Published by John Wiley & Sons, Inc., New York. Price $1.50 net.

Like the first edition of Ives Tables, published in 1924, this second edition is devoted to tables of trigonometric functions, both logarithmic and natural, in addition to tables of circumferences and areas of circles, tables of squares, etc. This edition has been amplified by an expanded table of trigonometric formulas, new stadia reduction tables and a table of formulas for differentiation and integration.



News of the Month . . .

Carloadings Hold Steady

Further gains in the volume of freight traffic handled by the railroads have been registered in recent weeks and in the week ending June 9 carloadings increased 2,084 cars above the previous week to a total of 617,649 cars, according to the Car Service division of the American Railway Association. While the gain over the preceding week was small, it was contrary to the seasonal trend which is usually downward for this time of the year. Carloadings for the week in question were the third highest so far this year, and were 24,890 cars greater than for the corresponding week of last year. The gain over the same week in 1932 was 99,251 cars.

3,250 Miles of Lines May Be Abandoned in Canada

Agitation for the adoption of measures to reduce the huge annual deficits of the Canadian National has led the management to the consideration of the wholesale abandonment of light-traffic lines and other lines that afford a duplication of service with the Canadian Pacific. According to Hon. Charles P. Fullerton, chairman of the trustees of the C. N. R., the two principal railways in Canada are considering 36 joint economy projects involving the abandonment of 2,100 miles of line, while, in addition, the Canadian National is considering proposals for closing 1,150 miles of light-traffic non-competitive lines.

Dotsero Cutoff Opened Formally on June 16

The 38-mile Dotsero Cutoff, which shortens the distance from Denver, Colo., to Salt Lake City, Utah, and Pacific Coast points by 175 miles, was formally opened on June 16 with ceremonies at Bond, Colo. The celebration began at 6:30 a. m. when the Zephyr, streamlined train of the Chicago, Burlington & Quincy, and three special steam trains of the Denver & Rio Grande Western left Denver for Bond where they arrived at noon. During the morning, two special Denver & Rio Grande Western steam trains also departed for Bond from Grand Junction, Colo., and Salt Lake City. The program at this point, broadcast over National and Columbia networks, included addresses by J. S. Pyeatt, president of the Denver & Rio Grande Western; L. W. Baldwin, trustee of the Missouri Pacific; Charles Elsey, president of the western Pacific; Ralph Budd, president of the Chicago, Burlington & Quincy; L. M. Allen, passenger traffic manager of the Chicago, Rock Island & Pacific; the governors of Colorado and Utah, and the mayors of Denver and Salt Lake City. The 2,000 persons attending the ceremonies were served a barbecue luncheon.

Grillage Timbers Sound After 42 Years' Service

Unwatering of the foundation of the draw-span pivot pier of the Missouri & Illinois Bridge and Belt Railroad bridge over the Mississippi at Alton, Ill., during the construction of the government locks at that point, has resulted in the exposing of the timber box grillage which serves as the means of distributing the pier load to the pile foundation. As the pier had been in service for 42 years, this circumstance has afforded an excellent opportunity to confirm the common understanding that wood submerged in water free from marine borers suffers no deterioration. All exposed portions of the grillage were found to be in excellent condition. To guard against the inception of decay until the timbers are again submerged, the exposed part of the grillage will be covered with wet sand.

Western Roads Reduce Rates on Drouth Shipments

Emergency rate reductions on shipments of live stock and feeds were placed in effect in the drouth-stricken areas of the West on June 2 by western lines, following approval earlier in the day by the Interstate Commerce Commission. Authority for those receiving the reductions is being granted by county organizations set up by the drouth relief commission. Live stock bought by the government for immediate slaughter is being carried at 66 per cent of the normal rate, while live stock moved to other pastures will be handled at 85 per cent of the one-way tariff with the option of return to the point of origin within a year for an additional 15 per cent. The rate on grain feeds is 66 per cent of the usual charge.

Tie Stocks on May 1 Show Slight Decrease

Reports filed with the Railway Tie Association by 14 companies which supply about 85 per cent of the crossties produced by commercial firms show that these companies had 7,182,452 crossties in stock on May 1. This was 209,554, or 2.8 per cent, less than these same companies had on hand on April 1 when tie stocks were greater than for any month since April, 1932. Of the ties available on May 1, 4,679,865, or 65 per cent, were 8 ft. long, and 2,502,687, or 35 per cent, were 8 ft. 6 in. long. U-ties for use untreated totaled 584,949, or 8 per cent of the total inventory, while oak ties for treatment numbered 4,416,977, or 62 per cent of the total. All other species for treatment totaled 2,180,526 ties, or 30 per cent of the inventory.

Most Supply Companies Now Operating Under Codes

Most of the companies engaged in the manufacture and sale of equipment, appliances, materials and supplies used by the railroads are now operating under National Recovery Administration codes of fair competition. Of the codes covering these industries, 10 represent industries engaged almost exclusively in the manufacture and sale of railroad equipment and appliances, while codes proposed for two other companies of this class are still in the stage of consideration and conference. Many other companies whose products are largely sold to railroads are included under more general codes, such as those for the iron and steel, lumber, steel castings, gray iron foundry, anti-friction bearing, nonferrous foundry, alloy casting, machine tool and forging machinery, and other industries. The first code for an industry devoted exclusively to railroad products was that for the railroad safety appliance industry, approved on January 12, while the most recently approved code is that for the locomotive appliance industry, approved on June 5. Pending final approval of specific codes the companies concerned have been operating under the terms of the President's Re-Employment Agreement.

Railway Labor Act Amendments Passed by Congress

A bill containing amendments to the Railway Labor Act of 1926, providing for the establishment of a National Railroad Board of Adjustment and a new National Mediation Board to take the place of the present United States Board of Mediation, was passed by Congress on June 18 and later signed by President Roosevelt. This bill, which was proposed by the Railway Labor Executives Association, offers to railway employees complete freedom to join a standard railway labor organization without influence from the companies. It definitely establishes the principle that the majority of any craft or class of employees shall have the right to determine who shall be the representative of the craft or class and, by providing for selection of the board of adjustment members by national organizations, deprives any minority of representation on such boards. The bill applies particularly to the adjustment of grievances arising out of the interpretation or application of agreements concerning rates of pay, rules, or working conditions, and provides in great detail machinery for the election of representatives of the employees and for the handling of grievances not locally adjustable.

Association News

The Wood Preservers Association

The executive committee of the American Wood-Preservers Association met at Buffalo, N. Y., on June 14 to formulate plans for the thirty-first annual convention, which will be held in New York on January 22-24, 1935. At this meeting, the Hotel Pennsylvania was selected as convention headquarters. The program for the convention was formulated and invitations will soon be issued to a number of prominent wood preservers and users of treated timber to address the convention, supplementing the reports of committees. The proceedings are now approaching completion and it is anticipated that they will be distributed during July.

Metropolitan Track Supervisors' Club

The annual business meeting of the club was held on June 9, at Keen's Chop House, New York, the following officers being elected for the ensuing year: E. E. Crowley, roadmaster, Delaware & Hudson, president; W. H. Haggerty, supervisor of track, New York, New Haven & Hartford, first vice-president; I. D. Talmadge, roadmaster, New York, Ontario & Western, second vice-president; and G. M. Cooper, Ramapo-Ajax Corporation, secretary-treasurer. Members elected to the executive committee were as follows: P. N. Wilson, superintendent track, Brooklyn Manhattan Transit Co.; B. Blowers, division engineer, Erie; and W. E. Gadd, The Rail Joint Company.

American Railway Engineering Association

Two bulletins, devoted largely to technical monographs, are about ready to go on the press. The first of these papers is on "The New Impact Formulas of Committee XV," by B. R. Leffler, bridge engineer, New York Central Lines, West of Buffalo. The second is a discussion of "The Calculation of Track Stresses of the Japanese Government Railways," by F. Inouye, engineer maintenance of way, Japanese Government Railways. One of the bulletins will also include the annual tie statistics compiled by the Bureau of Railway Economics.

Committee activities during June included eight meetings, of which the following were held at Chicago: Highways, on June 8, with 27 present; Shops and Locomotive Terminals on June 13; Economics of Railway Operation, on June 15, with 16 present; and Waterproofing on June 19, with 5 present. Other meetings were: Water Service, Fire Protection and Sanitation, at New York, on June 4 and 5, with 19 in attendance; Economics of Railway Labor, at St. Louis, Mo., on June 12, with 13 attending; Wooden Bridges and Trestles, at Madison, Wis., on June 22; and Yards and Terminals, at Pittsburgh, Pa., on June 25.

Although several committees expect to hold meetings in July, only three are as yet definitely scheduled, these being Maintenance of Way Work Equipment, at Chicago, on July 10; Buildings, at Chicago, on July 17 and 18; and Iron and Steel Structures, at Detroit, on July 12 and 13.

The Bridge and Building Association

The executive committee of the American Railway Bridge and Building Association met in Chicago on June 9 to reorganize the work of this organization and make plans for a convention in accordance with the advice received from the Western Association of Railway Executives that they would look with favor on a convention of this association this year. It was decided that the convention should be held in Chicago on October 16-18. A committee was appointed to select the hotel and make other necessary arrangements.

On Monday, June 18, officers of the Bridge and Building Supply Men's Association met in Chicago and voted to present an exhibit in connection with the Bridge and Building convention as heretofore. Efforts will be made to make this exhibit of a practical nature through the display of equipment rather than literature.

The Roadmasters Association

A largely attended meeting of members of the executive committee, together with the chairmen of standing committees and representatives of the Track Supply Association, was held in Chicago on June 16, 19 persons being present. Acting on authority received from the Western Association of Railway Executives, plans were formulated for a convention to be held in Chicago on September 18-20. It was decided to hold the convention at the Hotel Stevens. Reports presented by the various chairmen of committees showed that their work was well in hand and assured that constructive reports will be presented on timely topics. Arrangements were also made to invite a number of prominent railway maintenance and executive officers to address the convention.

Officers of the Track Supply Association reported that that organization is preparing plans for its exhibit, which has become an important feature of the conventions of this association. From the interest displayed by manufacturers to date and by reason of the fact that no exhibit has been held for four years, it is anticipated that the display of materials and equipment will be fully as complete as heretofore and will attract more than usual interest.

Barge Line Service Curtailed Because of Drouth

Because of the low stage of the Mississippi river due to the drouth, the Federal Barge Lines, which are operated by the government owned Inland Waterways Corporation, discontinued the acceptance of freight on June 4 for delivery at river points between St. Louis, Mo., and Minneapolis, Minn.

Personal Mention

General

J. Davis, district engineer of the Southern district of the Missouri Pacific, has been appointed acting superintendent of the Arkansas division, with headquarters as before at Little Rock, Ark. The position of district engineer at Little Rock has been temporarily vacated.

Maurice A. Long, formerly assistant to the chief engineer of the Baltimore & Ohio, has been elected chairman of the board of the Western Maryland, with headquarters at Baltimore, Md. **Charles W. Brown**, vice-president and general manager of the Western Maryland, whose service record includes many years in the engineering and maintenance of way departments of a number of roads, has been elected president, with headquarters also at Baltimore.

Mr. Long was born on October 25, 1875, near Middletown, Ohio, and entered railway service on June 5, 1899, as an architect and an assistant on the engineering corps of the Baltimore & Ohio. Five years later Mr. Long was appointed architect for this company and in February, 1913, he was appointed also assistant to the chief engineer. In September, 1919, he resigned from the service of the B. & O., to organize an engineering and construction company, known as the M. A. Long Company, with offices in Baltimore, Chicago and Allentown, Pa. Mr. Long has been a director and member of the executive committee of the Western Maryland since 1931.

Mr. Brown was born at Fort Gaines, Ga., on January 10, 1880. He entered railway service in the engineering department of the Central of Georgia in September, 1898. From 1900 to 1903, he was a transitman on the Baltimore & Ohio and from the latter date until 1904 he served as a resident engineer for the same road. Mr. Brown was an assistant engineer for the Atlantic Coast Line from August, 1904, to August, 1906, at which time he was appointed engineer of roadway for the same road. He held the latter position until May, 1908, when he became locating engineer for the Central of Georgia. In 1910 Mr. Brown was appointed superintendent of the Hall Parker Construction Company, which position he held until 1911 when he entered the service of the Lehigh & New England as engineer maintenance of way. In December, 1913, Mr. Brown became assistant superintendent on the latter road, serving in that position until March, 1917, when he was further advanced to superintendent. In June, 1927, he was promoted to general superintendent and in November, 1930, he was appointed general manager of the Western Maryland. Mr. Brown served in the latter capacity until May, 1933, when he became vice-president and general manager, the position he was holding at the time of his election to the presidency of the road.

Engineering

J. P. Bruton has been appointed assistant engineer on the St. Louis-San Francisco, with headquarters at Chaffee, Mo., succeeding **F. L. Peters,** whose appointment as roadmaster is noted elsewhere in these columns under track.

W. W. Portser, division engineer of the Wilkes-Barre division of the Pennsylvania, with headquarters at Sunbury, Pa., has been transferred to the Grand Rapids division, at Grand Rapids, Mich., succeeding **J. H. Schilling,** who in turn has been transferred to Sunbury to replace Mr. Portser.

R. D. Pierson, assistant division engineer on the Valley division of the Atchison, Topeka & Santa Fe, with headquarters at Fresno, Cal., has been transferred to the San Francisco Terminal division, and the position of assistant division engineer at Fresno has been abolished.

R. R. Nace, engineer maintenance of way of the New Jersey division of the Pennsylvania, with headquarters at New York, has been appointed chief engineer

R. R. Nace

maintenance of way of the New York Zone, with headquarters in the same city. Mr. Nace was born on August 27, 1882, at Philadelphia, Pa. He entered railway service in December, 1901, as a rodman on the Pennsylvania, serving in this capacity until 1905 when he was promoted to transitman. In the following year he was advanced to assistant supervisor and in 1911 he was further promoted to supervisor serving in that position until 1918, when he became agent at Mantua Transfer. Mr. Nace next served as freight supervisor for the United States Railroad Administration. From the latter part of 1919 until March, 1920, he was assistant engineer maintenance of way for the Pennsylvania and from the latter date until April, 1926, he served as engineer maintenance of way of the East Ohio division at Pittsburgh, Pa. He next served as superintendent of the Schuylkill division with headquarters at Reading, Pa., and in March, 1927, he was transferred to the Indianapolis division. In October, 1928, Mr. Nace was appointed chief engineer maintenance of way of the New York Zone of the Pennsylvania, with headquarters at New York, and when this position was abolished in May, 1932, he was appointed engineer maintenance of way, with headquarters at New York in which position he served until his recent appointment.

Track

F. L. Peters, assistant engineer on the St. Louis-San Francisco at Chaffee, Mo., has been appointed roadmaster with headquarters at Kennett, Mo.

W. E. Waygood, formerly a roadmaster on the Chicago, Burlington & Quincy and more recently a track inspector, has been appointed roadmaster of the Sterling division, with headquarters at Curtis, Neb., succeeding **H. W. Freeman,** who has been transferred to the McCook division, with headquarters at Denver, Colo.

Peter J. Gogan, assistant track supervisor on the New Hampshire division of the Boston & Maine, has been promoted to track supervisor on District No. 2 of the same division, with headquarters at Concord, N. H., to succeed **Patrick J. Quinn,** who has been assigned to other duties. **John H. Battis,** assistant bridge inspector on the New Hampshire division, succeeds Mr. Gogan as assistant track supervisor, with headquarters at Concord.

W. A. Erickson, an assistant section foreman on the Minneapolis, St. Paul & Sault Ste. Marie, at Schiller Park, Ill., has been advanced to assistant roadmaster, with headquarters at Mellen, Wis., to succeed **M. J. Lawrence,** who has been transferred to Glenwood, Minn., replacing **H. Medchill,** who has been granted an indefinite leave of absence because of ill health. **W. J. Johnson,** roadmaster with headquarters at Shawano, Wis., has been transferred to Rhinelander, Wis., replacing **P. G. Price,** who has been assigned to other duties.

M. S. Smith, whose promotion to supervisor of track on the Pennsylvania, with headquarters at West Brownsville, Pa., was announced in the June issue, was born on July 1, 1906, at Hughesville, Pa., and received his higher education at Pennsylvania State College, from which he was graduated in 1929. He entered railway service with the Pennsylvania on June 24, 1929, as assistant on the engineer corps, with headquarters at Lancaster, Pa., and on September 15 of that year he was promoted to assistant supervisor on the Baltimore division. Later he served in this capacity on the Philadelphia, Maryland, Atlantic, and Middle divisions, and was located on the Middle division at the time of his recent promotion to supervisor.

C. R. Uitts, assistant supervisor on the Middle division of the Pennsylvania, with headquarters at Lewistown, Pa., has been promoted to supervisor at New Castle, Pa. **A. M. Kennedy,** assistant supervisor, with headquarters at Rochester, Pa., has been transferred to the Middle division, with headquarters at Lewistown, Pa., to succeed Mr. Uitts. **A. M. Harris,** assistant supervisor, with headquarters at Harrington, Del., has been transferred to the Maryland division. **R. DeJaiffe,** assistant supervisor on the Maryland division, has been transferred to Wilmington, Del., on the same division to succeed **H. W. Swartz,** who has been transferred to the Baltimore division.

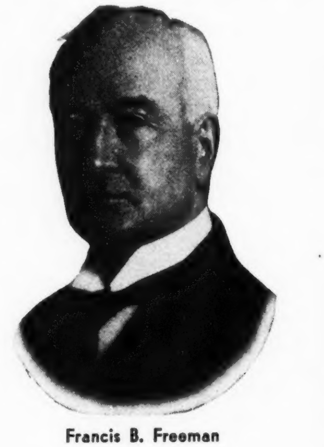
H. B. Russell, assistant supervisor of track with headquarters at Newcomerstown, Ohio, has been promoted to supervisor of track on the Grand Rapids division, with headquarters at Kalamazoo, Mich., succeeding **D. Horgan,** who is on a leave of absence because of ill health.

Bridge and Building

F. C. Ayer, a roadmaster on the Union Pacific, with headquarters at Marysville, Kan., has been appointed bridge and building supervisor of the La Grande district of the Oregon-Washington Railroad & Navigation Co., with headquarters at La Grande, Ore., succeeding **L. V. Chausse,** who has been transferred.

Obituary

Francis B. Freeman, who retired as chief engineer of the New York Central in September, 1933, died at his home in Orange, N. J., on June 14. Mr. Freeman was born on April 2, 1867, in Dublin, Ireland. He was educated at the Rathmines school and the Royal College of Science, Ireland, and entered railway service in January, 1886, as a mechanical apprentice in the Inchecora shops of the Great Southern Railway of Ireland. During the next five years Mr. Freeman was connected with various railroads in Ireland in the mechanical, construction and legal departments and also completed his education at the Royal College of Science. From 1892 until 1894, Mr. Freeman was assistant engineer for the firm of Kingsley & Brewer, civil engineers in New York, and served for a short time with the South Orange & Maplewood Street Railway. He entered the bridge department of the Erie as an assistant engineer in 1894, remaining in that position until 1900 when he became chief draftsman for



Francis B. Freeman

the New York Central & Hudson River. In 1901 Mr. Freeman was appointed assistant engineer in charge of design for the same road, then serving as assistant engineer of construction at Syracuse, N. Y. From 1902 to 1903, Mr. Freeman was engaged in other work, returning to the New York Central & Hudson River as assistant engineer of joint facilities and agreements on the latter date. In 1905 he became designing engineer and in 1907 he was promoted to engineer of construction of the same road. Mr. Freeman went with the Boston & Albany as chief engineer in 1909, remaining in that position until January, 1927, when he became chief engineer of the New York Central, Lines Buffalo and East. Mr. Freeman served in the latter position continuously until September, 1933, when he retired from active service because of ill health.

M. V. Hynes, assistant superintendent on the Baltimore & Ohio at Indianapolis, Ind., and formerly engineer maintenance of way of the Cincinnati, Hamilton & Dayton (now part of the B. & O.), died on May 28 at his home in that city. Mr. Hynes was born on July 28, 1868, at Cincinnati, Ohio, and entered railway service on June 1, 1889, as a rodman on the Cincinnati, Hamilton & Dayton. From January, 1890, to August, 1900, he held the position of assistant engineer and at the end of this period he went with the Cleveland, Cincinnati, Chicago & St. Louis as a supervisor of track. Mr. Hynes returned to the C. H. & D. in June, 1901, as engineer of construction, being appointed a roadmaster in 1904. In the following year he was advanced to division engineer and in March, 1912, he was further promoted to engineer maintenance of way. In June of the same year, Mr. Hynes was transferred to the operating department as superintendent, holding this position at various points until December, 1915, when he was made general superintendent of the Cincinnati, Indianapolis & Western (part of the B. & O.). In June, 1927, he was appointed superintendent on the B. & O. at Indianapolis, being made assistant superintendent there in 1932.

Byers Genuine Wrought Iron Plates—The A. M. Byers Company, Pittsburgh, Pa., has published a 16-page attractively printed booklet bearing this title which shows the many applications of Byers genuine wrought iron plates and sheets. A considerable part of the space in the booklet is taken up by a large number of photographs illustrating the various ways that these plates and sheets have been used.

FlexArc Cletrac Welders.—The Westinghouse Electric and Manufacturing Company has issued a four-page leaflet dealing with FlexArc welders, as mounted on Cletrac tractors for ready portability independent of the railway tracks. The leaflet describes fully the distinctive features of the new tractor-mounted units, including construction and operation, and lists the different combinations of welders and tractors in which the units are available.

Supply Trade News

General

The Tanner-Willard Company, St. Louis, Mo., has been appointed railroad sales agent for **The Cleveland Tractor Company** to handle Cletrac crawler tractors and equipment in the Southwest, supplementing the Austin-Western Road Machinery Company, industrial distributors for The Cleveland Tractor Company in this territory.

Railey & Milam, Inc., 27 W. Flagler street, Miami, Fla., has been appointed distributor of Enduro stainless steel and Toncan iron, and the **Ohio Valley Hardware & Roofing Company,** Evansville, Ind., has been appointed distributor of Toncan iron, according to an announcement made by the **Republic Steel Corporation,** Youngstown, Ohio.

The Western Wheeled Scraper Company, Aurora, Ill., and the **Austin Manufacturing Company** of Chicago and Harvey, Ill., will be consolidated under the name of the **Western-Austin Manufacturing Company,** with general offices at Aurora, effective July 1. **The Austin-Western Road Machinery Company,** Chicago, will retain its identity with its general office at Aurora and will continue as general sales agent of the new consolidation. **W. G. Sharretts** has retired as eastern sales agent of the Western Wheeled Scraper Company with headquarters at New York.

In commemoration of 104 years of progress and development, **Fairbanks, Morse & Co.** has devoted its entire 28-page summer issue of F-M News to the history and development of the company. "For Fairbanks, Morse & Co.," the issue begins, "the year 1934 marks more than a century of continual progress. The history of the organization dates back to the year 1830 when Thaddeus Fairbanks invented the first platform scale and with his brother, Erastus, manufactured them under the name of E. & T. Fairbanks." Many pictures of old and modern scales, internal-combustion engines, pumps, electric motors, rural and domestic products and inspection cars are shown.

Personal

Sydney R. Rectanus, vice-president of the **American Rolling Mill Company,** Middletown, Ohio, died suddenly in that city on June 22.

B. F. Moore, who retired as assistant to the vice-president of the Illinois Steel Company, Chicago, in 1932, died in Evanston, Ill., on May 25 following a paralytic stroke.

William E. Umstattd, executive vice-president of the **Timken Roller Bearing Company,** Canton, Ohio, has been elected president, to succeed **H. H. Timken,** who has resigned but who continues as chairman of the board. **Henry H. Timken,** Jr. has been elected a vice-president of the Timken Roller Bearing Company and a vice-president of the **Timken Steel & Tube Company.**

F. W. Copeland, formerly vice-president and still a director of the **Sullivan Machinery Company,** has been elected president of the **H. Channon Company,** Chicago, to succeed **H. G. Elfborg,** deceased.

A. W. Spaulding, chief engineer of the **Ingot Iron Railway Products Company,** Middletown, Ohio, has been elected vice-president. **E. T. Cross,** district manager at Atlanta, Ga., has been promoted to general manager of sales at Middletown. **J. L. Young,** district manager at Chicago, has been appointed general manager of the **Drainage Engineering Company,** a subsidiary of the Ingot Iron Railway Products Company, at Middletown. **W. P. Greenawalt** has been appointed district manager of the Ingot Iron Railway Products Company at Chicago.

E. S. McClelland, director of personnel of the **Westinghouse Electric & Manufacturing Company,** has retired after a service of 53 years with Westinghouse interests. With seniority outranking all other veterans of Westinghouse, Mr. McClelland at the age of 17 started with the company in 1881 as a helper in the foundry of the Westinghouse Machine Company. He subsequently became connected with the Westinghouse Electric & Manufacturing Company and was advanced through various positions until 1920, since which time he has served as director of personnel.

Five vice-presidents and one commercial vice-president were elected by the board of directors of the General Electric Company at its meeting on May 25 in New York City. **R. C. Muir,** Schenectady, N. Y., was elected vice-president in charge of the engineering department; **C. E. Tullar,** Schenectady, vice-president in charge of the patent department; **J. E. Kewley,** Cleveland, Ohio, vice-president in general charge of the incandescent lamp department; **E. O. Shreve,** Schenectady, vice-president in association with Vice-President J. G. Barry, in the commercial activities of the apparatus and supply business of the company; **H. L. Andrews,** Erie, Pa., was elected vice-president in charge of the activities connected with the electrification of steam railroads and such other duties as may be assigned to him by the president; and **W. O. Batchelder,** Chicago, was elected a commercial vice-president in charge of the commercial activities of the Chicago district.

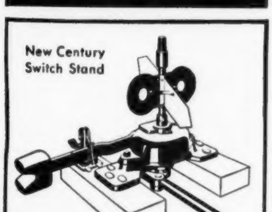
Testing and Qualification of Welders.—The Linde Air Products Company, New York, has published a 24-page illustrated booklet bearing this title, the purpose of which is to outline simple tests for measuring the ability of welders. Separate sections of the booklet discuss in detail the fracture test, the bend test, the tensile test and the observation test. It also contains a summary of existing and pending qualification tests for welding steel plate and pipe.

The Guard Rail for main line service today

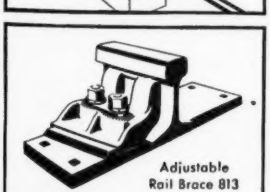
THE Bethlehem Hook Flange Guard Rail is made of *rolled* steel. It combines great strength with resilience.

At high speeds, when the back of a wheel flange comes in contact with the flare of this guard rail, it "gives" slightly, being resilient. It cushions the impact, straightens the truck without great shock and thereby guides the opposite wheels past the frog point without damaging blows. It's safe. Because of its rolled-steel construction it readily absorbs shocks that would otherwise cause severe strains, perhaps even cracks.

OTHER BETHLEHEM TRACK EQUIPMENT



New Century Switch Stand



Adjustable Rail Brace 813

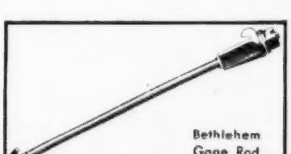
Heat-treated rail crossing

It may be going too far to say that the Bethlehem Hook Flange Guard Rail is unbreakable. Perhaps it *can* be broken, and maybe some day one will break. But this we do know: That of the many thousands of these guard rails in heavy, main-line service, some of them for a dozen years or longer, we've never heard of one that has broken. Not one!

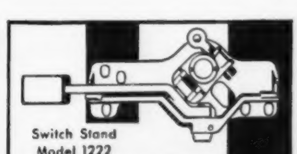
Modern, high-speed, main-line service calls emphatically for the Bethlehem Hook Flange Guard Rail.

This guard rail is one member of a large group of track specialties manufactured by Bethlehem Steel Company. The complete line of Bethlehem Track Equipment answers completely and satisfactorily every modern railway requirement. Each item represents years of experience; each is a leader in its field.

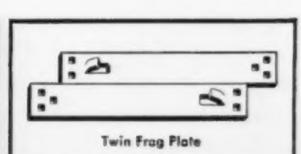
BETHLEHEM STEEL *Bethlehem Steel Company, Bethlehem, Pa.*



Bethlehem Gage Rod



Switch Stand Model 1222



Twin Frog Plate

BETHLEHEM *Track Equipment*

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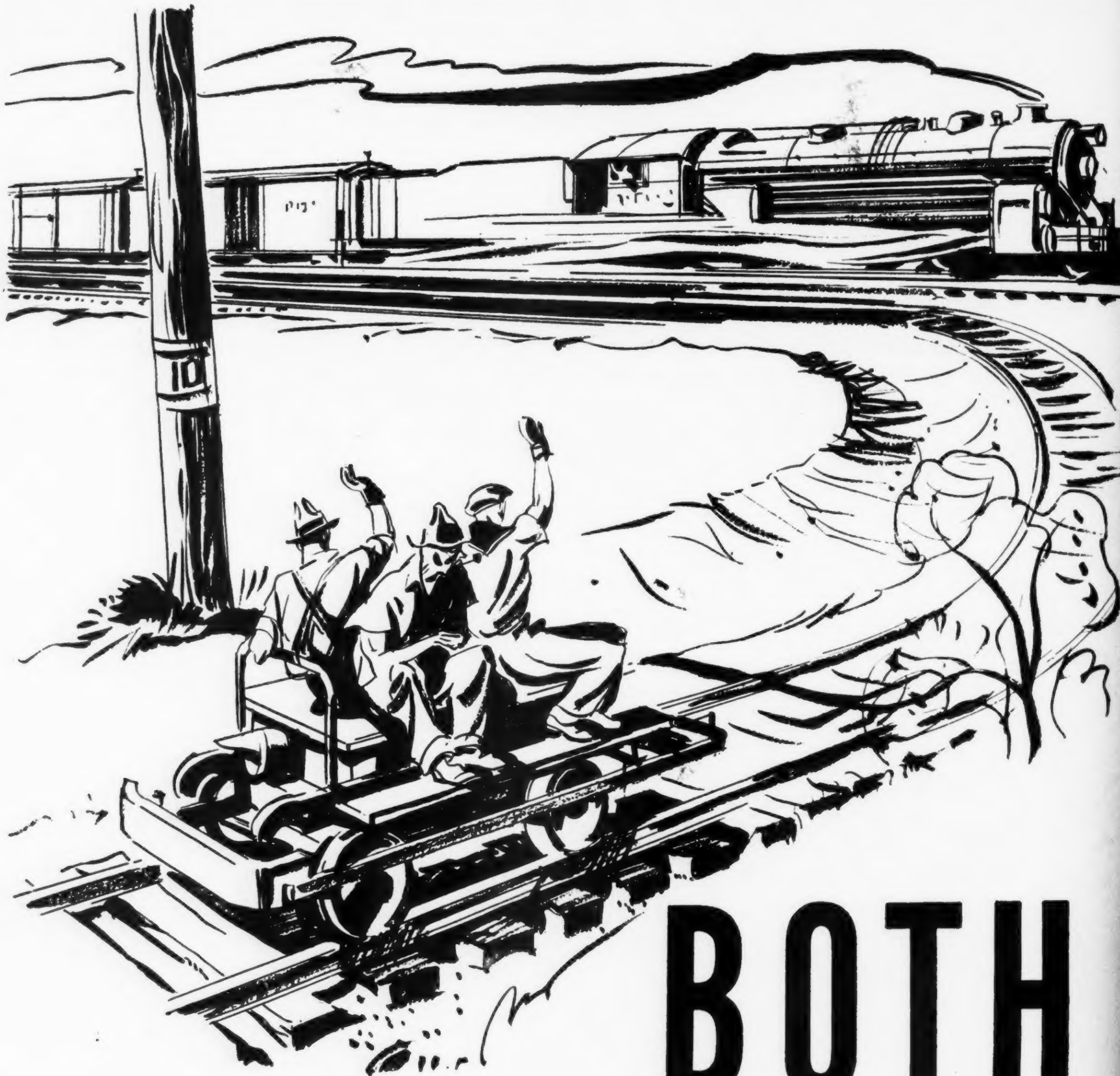
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